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The International Journal of Orthodontia Oral Surgery and Radiography

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On Page 10

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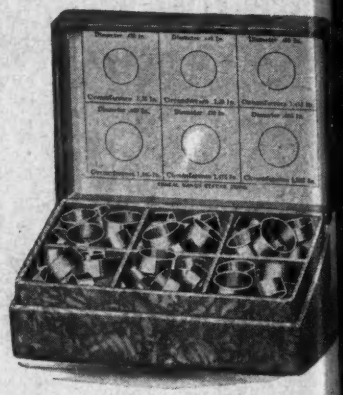

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VOL. XVI ST. LOUIS, JANUARY, 1930 No. 1

ORIGINAL ARTICLES

STUDIES ON APICAL ABSORPTION OF PERMANENT TEETH*

PART I

BY JOHN A. MARSHALL, D.D.S., PH.D., SAN FRANCISCO, CALIFORNIA

PRELIMINARY CONSIDERATIONS

A PORTION of the preliminary work on the problem of absorption of roots of permanent teeth has been reported in the proceedings of the Pacific Coast Society of Orthodontists.[1] It was shown at that time that, although the mechanism by which loss of tooth structure in roots of both deciduous and permanent teeth is apparently similar, yet the rate at which cementum and dentin are eroded shows certain distinct characteristics. Earlier studies on deciduous teeth[2] indicated that, contrary to the generally accepted viewpoint, the peridental membrane is not the only tissue concerned in bringing about the resorption of the roots of these deciduous teeth, but that when healthy pulp tissue is present it functions also in maintaining an increased rate of resorption.

It may be remarked parenthetically that this is another argument, if such is needed, for the importance of preservation of deciduous teeth. The children's dentist is only just coming into his own. His duties of instruction to both patient and parent in oral hygiene, as well as his filling operations, have a direct bearing upon the time at which the first teeth are shed.

Teeth with healthy vital pulps respond quickly to those forces which are concerned in the process of resorption of their roots. On the other hand,

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teeth which have become carious and which have developed infected pulps give evidence of delayed resorption. In the case of pulpless deciduous teeth, the apical reaction resembles more closely that which occurs too frequently at the apices of infected roots of permanent teeth. Here the loss of tooth structure is brought about by the cementoclasts of the peridental membrane. The resulting slow erosion of cementum and dentin has been termed apical absorption; this by reason of the fact that the process is essentially pathologic, whereas in the case of the normal shedding of deciduous teeth (resorption), it is physiologic and relatively more rapid.

These two processes then, although both responsible for apical erosion, are dissimilar in etiology, histogenesis and histopathology. For not only are different causes responsible for the apical resorption of deciduous teeth and of absorption of permanent teeth, but both the origin and development of the process may likewise be diverse. Furthermore in the case of deciduous teeth, the active process or resorption is speeded up at the last. But in the case of infected permanent teeth, where hard tooth structure is being removed, the rate of dissolution is slow but relatively constant as is indicated by the roentgenographic evidence. If conditions arise whereby tissue resistance in the infected area is lowered, or additional injury to the tissues occurs, the erosion of the remaining apex does not proceed any more quickly. Instead, however, the osseous structures are attacked, and an apical abscess of either an acute or chronic form develops. With deciduous teeth this is not the case. Any extra wiggle, so to speak, even so severe a twitch as to cause hemorrhage, may serve further to loosen the loose tooth. Frequently the child realizes this point by pulling out the tooth himself. But it is probable that by this time the crown is the only part of the tooth remaining, and the extra back-and-forth movement accomplishes merely a further loosening of the few residual fibers of the peridental membrane. No such result follows in the case of the permanent tooth, first for the reason that the attachment to the alveolar bone is more dense and firm, and second because the permanent teeth even in cases of radicular absorption rarely become loose enough to be extracted by the fingers; finally, it is very unusual to find that absorption of permanent teeth has progressed to such a degree that only the crown portion remains.

With these comparisons in mind, it is possible to discuss with somewhat more clearness the pathology of apical absorption occurring as a result of mechanical stress. Instances of this nature have been reported in the literature almost from time immemorial. It remained, however, for Dr. Albert E. Ketcham of Denver to correlate these observations in his own practice and to stimulate others to do likewise.[3, 4] As a result of his studies several interesting questions have been formulated:

1. In what proportion of orthodontic cases may apical absorption occur?
2. What relation has this occurrence to the *duration* and *type* of previous orthodontic treatment, and what is the relation to those cases where orthodontic interference has never been attempted?
3. Which factors are the more important in favoring the development of this condition, the local ones as represented by the general phrase "unusual

mechanical stress,'' or the general ones grouped for convenience under the term ''systemic causes''? If an unusual mechanical stress is responsible, in what way does it operate and how may it be avoided? If the body as a whole is at fault, in what direction does this fault lie and how may it be corrected?

EXPERIMENTAL

Animals and Methods.—The present research represents an attempt to answer some of these questions, by studying the effect produced in teeth and alveolar bone of macacus rhesus, under certain experimental conditions. When spring wire or other appliances capable of producing stress or strain are placed on teeth of animals, tooth movement occurs. It is obviously incorrect to designate this as an orthodontic treatment for the reason that at the start of the experiment the teeth are in regular alignment and at the end are irregular—the *ortho* or normal position has been changed to one of irregularity.

The similarity of the teeth of monkeys to those of man suggests the use of these animals for experimental purposes, and the macacus rhesus species, one of the easiest obtainable, has been and is being used.

The classification of mammals into the various classes, sub-classes, infra-classes, orders, sub-orders, families and sub-families, places the primates in the twelfth order among those mammals that develop their young within a placenta. In the second sub-order of primates occur the old-world monkeys, the family of Cercopithecidae, and this includes among others the baboons and macacus.[5] These are the animals used for this experiment.

That they are difficult to handle goes without saying. Confirmation on that point is too abundant. But that the experiment is feasible in spite of the many difficulties can also be proved. These troubles, like others, begin when animals leave home, and they seem to continue without interruption even through the laboratory procedures of preparing the tissues for histopathologic examination. In the first place strangers are disliked; the colony objects to visitors, and the only popular person with them is the cook. By gentle handling, however, they soon become reasonably tame and, aside from taking speculative nips at the operator's fingers now and then, are fairly tractable. A great deal depends on gentle handling and on patience and dexterity and technic. Roughness is never tolerated, nor teasing. The small boy, even when he wears long pants and has an academic or professional degree is excluded from the animal house if he begins to annoy the animals. In taking roentgenographs and in adjusting the appliances, it is essential that the operator wait until the animal adjusts himself to the new posture, or else rests from a cramped position, so calmness and patience are both necessary. Nor should the technical procedures be complicated; the simpler they are and the quicker they can be accomplished, the better. Thus the animal has little to fear and soon submits, although with a somewhat poor grace, to the various operations. But he does not fight except for cause!

The monkeys move quickly when they want to—and only then. They are cruel sometimes to their companions and again may exercise great patience

with them. They are appreciative, like humans, of little kindnesses; and once you make their acquaintance by offering choice little morsels of food, they tolerate more than one might expect.

They are frequently bored, especially when roentgenographs of the teeth are being taken, and finally they tire of too much attention and make known the fact in the only way they can. They have not shown any great dislike for the appliances which have been used. Only one has been lost in the year's time. When the bands become loose, a few moments for recementation is all that is necessary. The jaws are held apart by mouth props inserted first in the anterior part and then gradually pressed back to the molar region.

The experiment even at this early stage could not have advanced as far as it has without the sympathetic and able help given by Drs. Allen E. Scott and George H. Grover. These gentlemen have given freely of their time and experience to help along the work, and the society owes them a great deal for what they have accomplished. Furthermore, it gives me great pleasure to acknowledge my indebtedness to them and to express my appreciation of their work.

In a preliminary experiment with goats, which is still being conducted, additional assistance was rendered by one of the postgraduate students in orthodontia, Dr. R. A. Hering.

Only during the time when impressions are being taken is the animal anesthetized, and it would not be necessary even then except for the difficulty in keeping the jaws apart. The adjustment and fitting of the bands is done merely by holding the animal in a comfortable position and keeping the jaws open by mouth props.

Several have died during the course of the experiment. Nearly all have lost weight. Even those on a supposedly regular diet have not been as healthy as they should be. One of the reasons for this is that a persistent form of dysentery has developed, and there have been instances of both bacillary and amebic infections. Only one animal has developed a well-defined tuberculosis, and that one was not immunized against the disease by B.C.G. vaccine; the others have been so protected.

The animals on restricted diet do not thrive. Several times it has been necessary to discontinue the special food prepared for them and to change to the regular ration given the control. However, this much has been accomplished: the amount of vitamin A has been low throughout the experiment; mineral salts, utilizable protein, carbohydrate and fat have been kept, as far as could be determined, at the optimum, as well as the other vitamins, including E of Evans.[6]

COMPARISON WITH DIETARY EXPERIMENTS ON RATS

When a comparison is made between the dietary experiments on rats and those on monkeys, there is this difference: with the rat it has been shown that the antiscorbutic, water-soluble vitamin C is unnecessary, because these animals seem to thrive equally well without its being included in the diet. But with the monkeys, although no scurvy has been observed, it was thought advisable to include the antiscorbutic substance in the food.

The special ration was given in the form of small cakes. The alcohol-extracted casein, irradiated lard, corn starch and mineral salts are cooked to a mush-like consistency, cooled and then molded into small squares or cakes. These have been eaten, but under protest. When a little oat flour and white sugar are added down to 5 per cent of the total, the ration is taken with better relish, but even this minor change is not entirely desirable. For after a few weeks additional items must be added; otherwise the animals lose weight and become ill. When lettuce, fruit and bread are given for a few days, the animals improve rapidly and return to a more normal condition. Then they are placed on the special food again.

The many factors entering into a study of the dietary requirements of captive animals—particularly macacus rhesus—are not known, and it is absolutely necessary to conduct a well-formulated and extensive research along this line. These metabolism studies must naturally be carried out in conjunction with others dealing with those infectious diseases to which the several species are subject.

The percentage composition of the various rations for the rat experiments has been published elsewhere,[7] and the modifications of these diets necessary for this present experiment will be made the basis for a supplementary report.

The original plan of the experiment as outlined in a report published earlier[8] has not been changed in any essential detail. The animals were divided into two main groups. One group has been fed a regular diet throughout the course of the experiment. It consists of fruit, vegetables, nuts, bread and occasionally meat. The second group has subsisted, with the modifications mentioned above, on a ration deficient in, but not lacking entirely, vitamin A. Each of these two groups is again divided into two more groups making four in all. Some of these animals are to be used for purposes of comparison and have not had bands or other orthodontic appliances placed on the teeth. The other group, members of which are in both dietary divisions, have had bands placed on incisors, canines, or molars, or all three. The teeth are being moved out of their regular alignment, and the following changes have been accomplished at this time:

1. Bands cemented on maxillary permanent central incisors are connected by spring wire. The tension on the wire is such that the teeth are moved distally.

2. Rotation of teeth by means of silk ligature, attached to hooks on fitted bands, has been accomplished. This movement was effected by soldering hooks on the fitted bands on the central incisors.

3. One central has been depressed and the other elongated; this by means of spring wire.

4. One central has been moved labially and the other lingually.

The work has been so planned that similar orthodontic experiments are being conducted in each of the dietary groups. Eventually there will be animals undergoing analogous tooth movement on each of the imposed rations. The one jaw which has been prepared for study and which will be shown on the screen is from an animal on a regular diet. The central incisors were

moved distally about one quarter of an inch. The other animal undergoing the same type of tooth movement was on a special diet.

Roentgenographs have been made at the beginning of the experiment on all the animals. Additional ones have been made from time to time during the course of tooth movement and again when the animal died or was sacrificed. I have been extremely fortunate in securing the head of a macacus rhesus 366 days old. This one was born in captivity in the laboratories of Dr. Carl Hartman at Johns Hopkins University. Furthermore he has been kind enough to offer additional facilities for observation of his colony. Since most of these monkeys have been bred in his laboratory, the complete statistics and data pertaining to each animal are available.

EXPERIMENTAL PROTOCOLS

The animals have been brought from India and Borneo. Some of them have been secured from the London and some from the New York Zoological Gardens. Problems of transportation are serious, and sometimes the entire colony perishes before delivery is made. Naturally such accidents are beyond the control of the purchaser and he stands no loss. The price of the animals is figured delivered at the laboratory in a healthy condition. Cages for housing are metal with removable bottoms filled with sawdust. This is changed daily. In the outside wall of the room is a sliding door leading to exercise cages built on the exterior of the building. The experimental details of each animal follow and include notations as to diet, type of appliance, roentgenographs, etc.

Monkey No. 2. Special diet. October 12, 1928. Subperiosteal abscess on occiput.

November 16, 1928. Molar band and lingual wire placed. The left maxillary deciduous second molar and the mandibular left first molar were both extracted on this same date. Mesiolingual rotation of maxillary permanent left first molar. Labial movement of both permanent central incisors, with pressure on the right greater than on the left.

December 14, 1928. Molar band tightened. Right central incisor elongated, left one depressed.

December 21, 1928 and January 4, 1929. Bands in place.

January 9, 1929. Animal dead in cage. On autopsy found great number of intestinal parasites. Diagnosis: cause of death, amebic dysentery.

Monkey No. 9. Special diet. October 17, 1928. Impressions, band measurements and roentgenographs.

October 24, 1928. Maxillary permanent central incisors banded, depressing left central, elongating right central.

November 14, 1928. Bands in place.

December 12, 1928. Special diet.

March 13, 1929. Placed on full diet again for one month.

March 22, 1929. Pictures and roentgenographs.

April 16, 1929. Special diet.

April 24, 1929. Regular diet.

June 5, 1929. Special diet. Appliances lost and teeth have returned to their original position.

Monkey No. 35. Regular diet.

September 28, 1928. Impressions and roentgenographs. Molar bands on maxillary permanent first molar and bracket band on right and left maxillary deciduous canine and right central permanent incisor.

October 19, 1928. Anterior band lost and replaced. Appliance now consisted of a band on first molar, canine and incisor connected with a ribbon arch wire.

October 22, 1928. Bands in place but no tooth movement.

October 26, 1928. Bands tightened.

November 2, 1928. Canine band had worked loose and was recemented. The arch wire was removed.

November 7, 1928. Canine band lost.

November 9, 1928. New right canine band and arch wire; adjusted to produce labial depression of right central incisor, depression of right canine and distal tipping of right molar.

December 14, 1928. Broken molar band, wired central incisor and canine producing rotation of right central incisor and labial movement of right canine.

December 21, 1928. Bands in place.

January 4, 1929. Bands in place. Blindness developing.

January 25, 1929. Bands lost and replaced. Animal nearly blind.

March 1, 1929. Labial movement and distal rotation of right central incisor. Some depression and mesial rotation of right canine.

March 19, 1929. Animal died. Autopsy: amebic dysentery.

Monkey No. 1. Regular diet.

October 28, 1928. Impressions.

December 5, 1928. Bands placed on maxillary permanent central incisors and roentgenographs taken. Mandibular deciduous left central incisor broken off during operation. Rotation of maxillary central incisors produced by grass-line ligature.

December 19, 1928. Ligatures lost and new ones placed.

March 13, 1929. Left central band replaced.

March 20, 1929. Pictures and roentgenographs.

April 17, 1929. Left central band recemented and new ligature.

May 21, 1929. New ligature. Animal gradually losing weight.

June 5, 1929. Hook on left central incisor is toward distal on the lingual surface. On right central incisor hook is toward distal on labial surface.

Monkey No. 12. Regular diet.

November 23, 1928. Impressions, bands on maxillary permanent left first molar, on maxillary permanent left central incisor, on maxillary permanent right central incisor; roentgenographs.

December 21, 1928. Bands off and replaced. Buccal movement of maxillary left deciduous first molar. Labial movement of maxillary permanent left central; lingual movement of maxillary right central.

January 4, 1929. Bands in place. Only very slight tooth movement.

January 25, 1929. Slight movement of anterior teeth, lingual rotation of deciduous molar.

March 1, 1929. Marked labial movement on left central incisor. (It was noted that for some reason, as yet undetermined, a chronic apical abscess developed over apex of mandibular permanent left central incisor. Animal showed a marked torticollis, holding head downward and to right.)

April 26, 1929. Bands in place.

May 20, 1929. Weight 6⅛ pounds. Impaired vision and partial paralysis of right arm.

Monkey No. 3. Special diet.

September 26, 1928. Impressions, roentgenographs.

October 3, 1928. Bands fitted to maxillary permanent central incisors. Hooks and grass line for rotation.

October 10, 1928. New grass line.

October 22, 1928. Bands and grass line in place.

November 14, 1928. New grass line.

December 12, 1928. New grass line.

March 13, 1929. Right central incisor rotated clock-wise, left central incisor rotated clock-wise with slight labial movement. New grass line.

March 22, 1929. New grass line. Special feeding of bread and carrots. Animal gradually losing weight.

March 27, 1929. New grass line.

April 3, 1929. New grass line.

April 16, 1929. Animal on restricted diet.

April 17, 1929. New grass line.

April 20, 1929. Replaced on regular diet.

May 7, 1929. Animal died as result of a battle with No. 9, his skull having been fractured.

Monkey No. 4. Special diet.

September 14, 1928. Anesthetized and impressions of maxilla taken. Too much ether given and resuscitation was difficult. Bands measured for maxillary incisors and roentgenographs made.

September 19, 1928. Bands placed on maxillary permanent incisors in such manner that tooth movement on No. 81 is duplicated on this animal. The movement is distal and somewhat labial.

October 22, 1928. Bands in place.

November 14, 1928. Bands in place.

December 12, 1928. Bands in place.

March 13, 1929. Considerable mesiodistal movement has been accomplished. Tension on wires increased.

March 20, 1929. Roentgenographs; bands in place.

March 29, 1929. Bands in place.

April 3, 1929. Bands in place.

April 17, 1929. Bands in place. Animal losing weight.

April 24, 1929. Placed on regular diet.

June 5, 1929. Bands OK. Special diet again.

June 17, 1929. Convulsions 10 A.M. and motion pictures.

July 2, 1929. Dead. Autopsy showed double pneumonia.

Monkey No. 81. Regular diet.

May 9, 1928. Roentgenographs and impressions. Bands on maxillary permanent central incisors.

May 18, 1928. Centrals have already separated nearly one-fourth inch.

July 1, 1928. Bands in place.

August 1, 1928. Bands lost and teeth still separated.

September 1, 1928. Teeth back in normal position.

September 5, 1928. Roentgenographs.

September 15, 1928. Bands replaced.

October 12, 1928. Bands in place.

November 12, 1928. Bands in place.

December 19, 1928. Bands in place.

January 18, 1929. Animal died. Autopsy: bronchial pneumonia and follicular enteritis in both large and small intestines.

HISTOPATHOLOGY

The microscopic study of the maxillary incisors and surrounding tissues from animal No. 81 has been based upon 229 serial sections. These have been stained with the usual differential stains as hematoxylin, eosin, van Gieson, Mallory connective tissue stain and Schmorl thionin-picric acid solution. A small reconstructed wax model has also been prepared.

This animal, on a regular diet and presumably healthy at the beginning of the experiment, had appliances placed on the maxillary permanent central incisors from May 9, 1928, until January 18, 1929, at death, only a little over eight months. In spite of the fact that the time was short, the histo-

pathologic picture demonstrates that some exceedingly interesting changes have taken place. During the entire period of treatment the maxillary deciduous lateral incisors were in the jaw. Extending upward from the rapidly resorbing apices of these teeth are the forming crowns of the permanent lateral incisors as shown in Fig. 4. At the left of the picture is a transverse section of the root of the deciduous canine. The degree of resorption of the apical portion of the deciduous lateral incisors is shown in Fig. 5. A portion of the cementum has been absorbed and only a relatively small amount of the

Fig. 1.—October 28, 1928. Band placed in May, 1928.

Fig. 2.—Side view. October 28, 1928.

dentin remains. The alveolar bone is also reduced. Attention is next invited to Fig. 6. This low magnification is given to show the relative position of the central and lateral incisors at this depth in the block of tissue. It will be noted first that, on account of the curvature of the roots of the central incisors, merely the apical area of the pulp canal and contents are demonstrable at this depth. Only a small portion of the deciduous lateral incisors remains as well as the supporting alveolar bone.

Situated distally and higher in the maxilla are the forming crowns of the permanent lateral incisors. The higher magnification as shown in Fig. 7

demonstrates: first, the very fragile character of the organic matrix of the forming enamel; next, the dentoenamel junction is clearly outlined, and proceeding inward is dentin, predentin and dental pulp. These structures were much more easily decalcified than the dentin and enamel of the deciduous lateral and the permanent central incisors.

Fig. 3.—End of experiment, January 27, 1929.

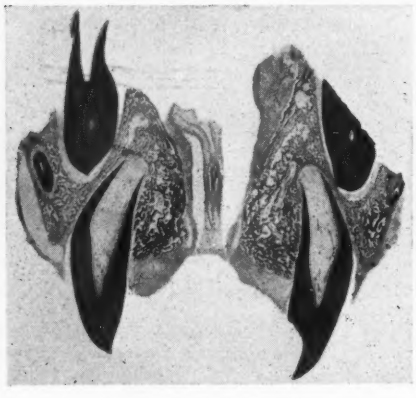

Fig. 4.—Deciduous and permanent lateral incisors. H. and E. Enlarged five times.

Next in order is the study of the permanent central incisors and their supporting structures. A portion of the gingival epithelium, its underlying connective tissue and the alveolar crest are shown in Fig. 8. Even with this relatively low magnification ($\times$ 19) the figure indicates a distinct stress in the connective tissue fibers. The attached peridental membrane fibers have been stretched almost apart by the distal movement of both crowns of the teeth. The continuity of the fibers, however, remains unbroken.

In the apical region considerable changes have occurred in both the cementum and the peridental membrane. In Fig. 9 the irregularity of contour on outer border of the cementum and pulpal wall of the dentin is quite apparent. There is a noteworthy difference between normal and pathologic tissues. For in the first case both dentin and cementum are laid down evenly without noticeable variations of thickness, or broken and irregular contour.

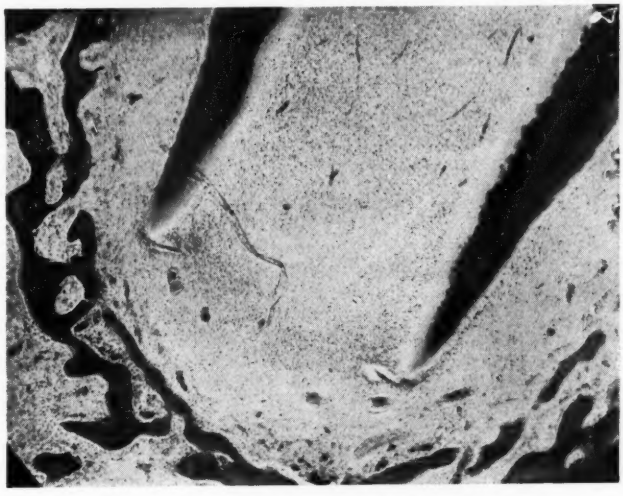

Fig. 5.—Apex of deciduous lateral. Complete cementum and partial dentin resorption. Alveolar bone thinning out.

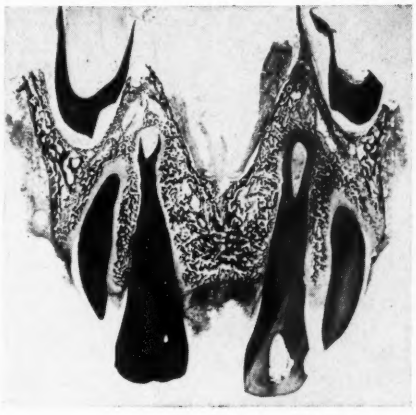

Fig. 6.—Showing relative position at this particular depth in the tissue of the permanent central incisors and the deciduous and permanent lateral incisors.

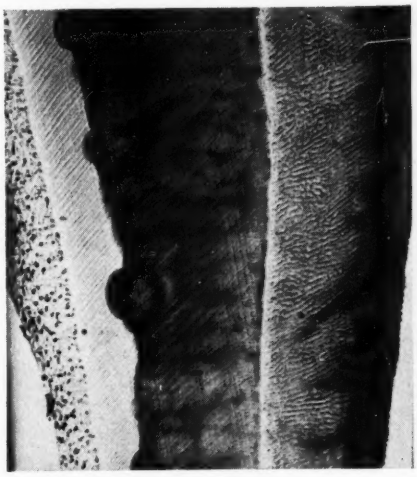

Fig. 7.—Forming enamel and dentin of permanent lateral incisor showing portion of enamel matrix, dentin and predentin matrices, and a small portion of the dentogenetic layer of the dental papilla.

The illustrations present the opposite condition. In place of the regularity of contour there are small notches indicative of an interference in the normal process of cementum formation. It is true that well-defined, eroded areas, such as have been noted in clinical cases of long standing apical absorption, are not demonstrable in this animal; but when it is recalled that the appliances

were in place only eight months, we may assume that the tissue changes, although severe in so far as peridental membrane and bone are concerned, had not developed to a like degree in the cementum. Several eroded places on cementum areas are more highly magnified in Figs. 10, 11, 12. It will be

Fig. 8.—Gingival epithelium, underlying connective tissue and alveolar crest between two permanent central incisors. Enlarged nineteen times.

Distal aspect

Mesial aspect

Fig. 9.—Apex permanent left central incisor.

recalled that the apices of these teeth were being forced together as their crowns were moving apart. Therefore one would expect to find somewhat more apical erosion on the mesial aspects of each root than on the distal. But the evidence on this point is still inconclusive. There are, it is true, more

places which are superficially eroded on the mesial portions of each root, but the distal aspect also presents a few scattered areas. This is shown in Fig. 12. Of outstanding significance, however, is the great amount of fibroblastic activity occurring around the roots. It is probable that the force used in moving

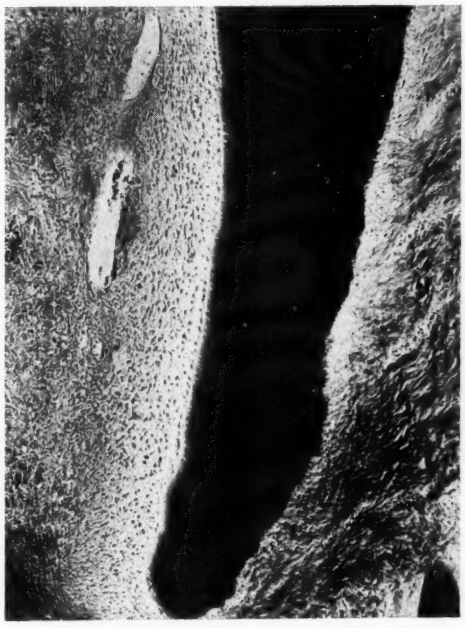

Fig. 10.—Mesial canal wall of permanent left central incisor. Marked fibroblastic activity.

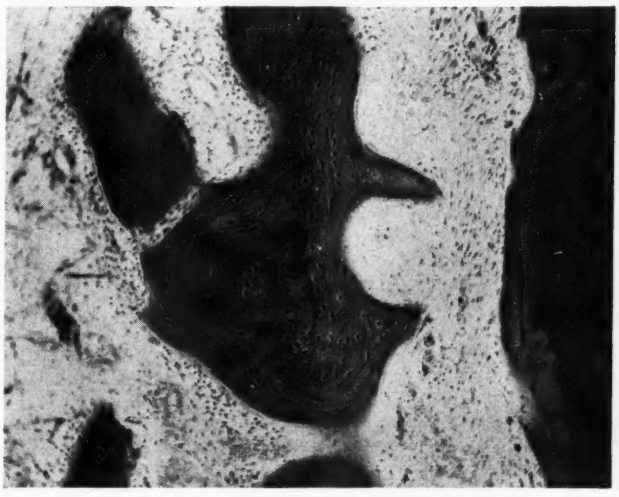

Fig. 11.—Cementum absorption.

the two teeth has brought such stresses to bear on the bone in the apical region that osteoclastic action and resultant tearing down of osseous tissue have been followed by an extraordinary fibroblastic response. For example in Fig. 12, the thickness of the peridental membrane and the coarse character of the fibers contained therein suggest that an active change in the position

of the alveolar wall is in progress. The relatively large degree of porosity of bone is unusual in this area and indicates that osseous changes are rapidly occurring.

The bone of the alveolar crest between the two teeth is shown in Fig. 13. The tissue here is apparently normal. About 5 mm. from the crest, however,

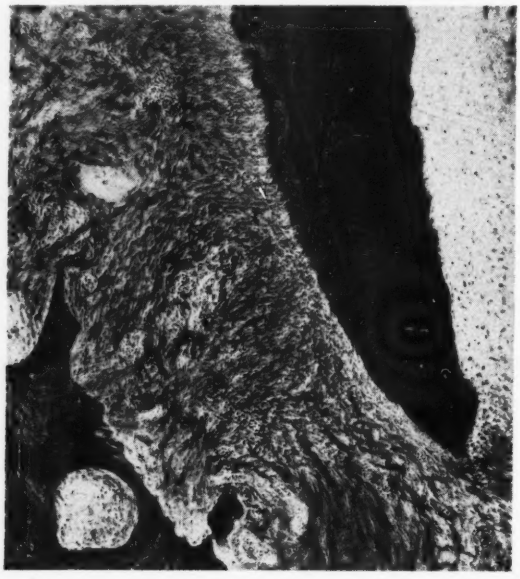

Fig. 12.—Distal aspect of permanent left central incisor. Previous bone absorption has been followed by great fibroblastic activity. There is much more cementum here than on the mesial portion and of nearly uniform thickness.

Fig. 13.—Normal bone at alveolar crest between central incisors. Schmorl stain.

an irregular white line crosses the osseous tissue as shown in Fig. 14. It will be noted that this line has a transverse direction extending from the border of the alveolar bone of one central incisor transversely across to the other one. With somewhat higher magnification this white line throughout its extent proves to be a distinct fracture. This is shown in Figs. 15 and 16. It is suggested that this was the point of greatest stress, the movable fulcrum, so

to speak, of the lever which forced apart the crowns of the teeth. It is apparent that in the effort to produce apical absorption in this experiment too great a tension was applied. When measured by spring balances, it required one and three-fourths pounds pressure to return the bands to the position they

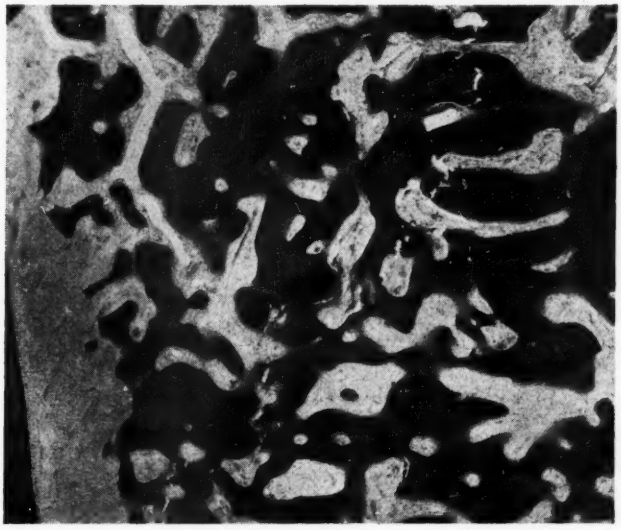

Fig. 14.—Fractured bone about 5 mm. apically from alveolar crest. Note irregular white line extending transversely across the field beginning at the lower left-hand corner.

Fig. 15.—Fractured alveolar bone midway between apex of root and gingival crest of root.

occupied at the beginning of the experiment before the teeth commenced their movement. This introduces an interesting side light on the problem, namely: how may the tension which is imparted to spring wire be measured before, during, and after an experiment or even during the progress of orthodontic treatment in the office? I have seen no published reports on this matter.

In summarizing the work so far accomplished it can be stated that orthodontic appliances have been placed and maintained in position on eleven experimental animals (macacus rhesus).

The segregation of the colony is as follows:

Animals with appliances:	
5 dead	special diet
2 dead	regular diet
2 alive	special diet
2 alive	regular diet
Animals without appliances:	
1 dead	beginning of experiment, from anesthetic
1 alive	special diet
2 alive	regular diet
15 animals in all	

The laboratory examination of the dental tissues up to this time has been completed on one animal, and the following points have been demonstrated:

Fig. 16.—The line of fracture extends transversely between the two central incisors.

first, that apical absorption occurs even though the appliances have been in place for so short a time as eight months, but so far the only evidence of the fact is the histopathologic examination of the tissue. The roentgenographic picture has been uniformly negative. This will be made the basis of a separate report.

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DISCUSSION

Dr. Harry E. Kelsey, Baltimore, Md.—I assure you I shall not detain you long with a discussion which cannot be very profitable, first, for the reason that I have no familiarity with Dr. Marshall's work and methods of procedure, except such as I have gained here

this morning, because I have had no chance to study them before, though I have a certain familiarity with the experiment as a whole, gained through letters from Dr. Marshall, Dr. Ketcham and others.

I want to say at the outset that Dr. Ketchem, when he introduced Dr. Marshall, expressed to you better than I could what I should have tried to say.

To this I want to add that it seems to me this Society has been extremely fortunate with its first experiment in donating money for scientific research. If we had made two or three mistakes and got nothing out of our first attempts in research for money expended and had then had the good fortune to get what we have through this first attempt, we would have been well repaid. Through our first venture we have interested men and institutions which are repaying us almost immediately in results. The character of the man who is conducting this research would alone guarantee that something worth while would be produced. He is a man who is after truth, and if the results of his entire experiment should prove to be negative, we should be as well repaid as though they were positive. I believe at least he is not setting out to prove some favorite hypothesis. He is making an experiment and feels it should lead where it will. If this disproves a hypothesis, it is just as valuable to us as if it corroborated it.

Another experiment by Dr. E. V. McCollum at the Bureau of Animal Industry of the Department of Agriculture under the patronage of the American Dental Association, of which I am adviser, according to the American Dental Association plan, may be compared with Dr. Marshall's work. It is being conducted on swine, and I am hoping there will be some corroborative evidence so far as the diet phases are concerned between it and Dr. Marshall's experiment. I am very glad to hear that Dr. Marshall intends to come to Baltimore, and I hope we will have the opportunity of showing him what is being done there in this, to some extent, similar experiment.

The great value of this research to us, as orthodontists, is the fact that Dr. Marshall is carrying on an experiment in orthodontic procedure (and it seems to me with astonishing success) in which there will be an opportunity for making roentgenographic and histologic studies of the tissues after they have been subjected to orthodontic interference, a thing which is of course obviously impossible with human patients.

I would like to express, what I believe every member of the Society here feels, my great satisfaction at the wonderful returns we are getting for the small amount of money invested. I am sure that Dr. Marshall, if he can continue to carry on this work, which is so creditable for the short amount of time spent, will give us results in a number of years which may go far toward answering some of our most difficult problems.

Dr. Martin Dewey, New York City.—There is not very much that I can add to what Dr. Kelsey has said except to call your attention again to the fact that research work is very often disappointing. However, in this case we seem to have made more progress in selecting our men than is generally the case.

Regarding the result which has been obtained, you will notice first that no roentgenographic evidence has been observable in the radiogram taken up to the present time. Only a certain amount of histologic evidence is present.

In reference to the alveolar process which was fractured as a result of pressure on the teeth, I think that is a note of warning in regard to the application of force. I do not remember how much pressure was placed on the spring. If I remember correctly from reading the manuscript which he turned over to me yesterday, he stated that it required something like one and three-quarters pounds to bring the spring back to its regular pressure.

To my mind, that is a tremendous pressure in comparison to what we exert on orthodontic appliances. With the auxiliary springs I think the pressure recommended is three-quarters of an ounce. In that respect I rather believe the investigators should check up, or they are going to produce results that are not produced by orthodontic tooth movements. The pressure will not be too great.

I realize they are anxious to get results. I did that experiment on my dogs. This must be carried on far enough. After you get these tooth movements by rapid pressure, you have to go back and check up on lighter pressures and see what occurs then.

It is going to require years for the American Society of Orthodontists to enter the field of investigation. I hope you will keep the interest up and not withdraw. The President again recommended the assessment which you will all see is necessary for carrying on if this is going to go far to produce the things that could be produced if these various experiments are carried on to completion.

Dr. Guy S. Millberry, San Francisco, Calif.—Those of us who are closest in contact with this experiment have enjoyed the research probably much more than you have from the visualization of it this morning.

One of the interesting phases of it, which was called to my attention from the earliest inception of the program, was the thought of most orthodontists and most dentists that it would be impossible to work with monkeys; they were intractable, impossible to handle, so active all the time that nothing could be done with them. This experiment has proved that Dr. Marshall, at least, has been able to handle the monkeys, with the assistance of those orthodontists who have helped him, with little or no difficulty whatsoever.

One of the difficulties he did experience was the adaptation of appliances used to the arches of monkeys because the molars are very close together. It is difficult to get molar bands on and apply the spring wires to the anterior teeth.

The support which Dr. Karl F. Meyer, director of the Hooper Foundation, has given to this enterprise is commendable. He has been very happy in assisting us in that work. Two pieces of dental research are being carried on in the Hooper Foundation, and he has added to his department of medical research some of the most interesting dental problems that have yet been placed before the profession.

In support of this research, I have used every effort I could to induce the American Dental Association to yield some of its research funds to this Society to help; not so much to help you as orthodontists, because the dental profession seems to feel that the orthodontists do not need any financial help, but the children of these United States do need the help of the dental profession. I dare say 98 per cent of you are members of the American Dental Association, and so far that organization has not expended a single penny on orthodontic research during the fifteen years of its research endeavor.

This year I requested that the commission grant at least $1,500 for the continuation of this research to help you in your cause, but more particularly to help the children. We are repeatedly hearing reports, both from dentists and from orthodontists, of the serious disasters that occur from absorption of the roots of permanent teeth. Many cases have been reported to me since this investigation began, and it is Dr. Ketcham's desire that this particular phase of study should be continued until something is known about it.

You may also be interested to know that when the first publicity was given to this program through the University News Clip Sheet, which is sent to the papers throughout California and the United States, and it was known that we were carrying on some orthodontic research on monkeys, Pathé News and the International News persisted daily for a period of two weeks to endeavor to get news reels of this particular experiment. Dr. Marshall was constantly solicited by these men to give them information and moving picture material because it was a very good news story, and they wanted to run it in the movies all over the United States. We had a further inquiry from some woman in the vicinity of San Francisco who felt that there were so many poor children who needed orthodontic treatment, she wondered why we dealt with monkeys. She thought it would be more desirable to spend this money on the poor children who needed it.

Dr. Martin Dewey, New York City.—It seemed to me the last speaker got off entirely on the wrong track in suggesting that these experiments be duplicated on children. In most states there seems to be a law against killing your patients after you get through with them.

The real value of these experiments lies in the fact that we are going to get histologic evidence of tissue changes as the result of tooth movement. If anyone is able to induce some of these state legislatures to change the laws so we can dispatch with some of these children and get the specimens, I agree with the speaker. It seems impossible that that can be accomplished.

As I said before, I want you to remember that these experiments are not exactly the same as you have on your patients; still they are the only means we know of at the present time. It is the only feasible means of getting this material to demonstrate histologic changes as a result of tooth movement. These experiments will have to be done hundreds of times and all summed together before we can finally get the analysis Dr. Marshall is working for.

Dr. John A. Marshall, San Francisco, Calif.—In reply to the gentlemen who have been kind enough to discuss my paper, I want to extend my thanks.

May I also take a moment to state that these experiments are being conducted with the same consideration that is shown clinical patients. If the animals objected to the bands, how long would the appliances remain on their teeth? About two minutes. The monkeys have very great strength in their fingers. If they were suffering any inconvenience, they would take the bands off. This has happened in one case. We found the tension on the band was too great; when the tension was relieved, there was no more difficulty.

I want to say that Dr. Dewey's point, in so far as the fracture is concerned, is very well taken.

I should also like to point out that the object of this preliminary experiment, because it will only be termed a preliminary experiment, was to produce apical absorption. If this cannot be done in the laboratory, there is no need in making any additional experiments. But that it *has* been accomplished is an indication that further work is necessary. In order to answer the question, "Why?" bands must first be so adjusted that absorption will follow. Then by modifying the tension on the bands and by using various types of appliances, as the experiments indicate may be necessary, the problem will be more clearly defined. Whether the type of the appliance, or the manner of its adjustment, or the peculiarities of other local conditions are to be held solely responsible, or only partly so, remains to be determined. It is essential that we keep an open mind; that the problem be studied without any preconceived ideas, and finally that all the facts in the case be presented impartially.

This preliminary experiment, then, was designed purposely to move the teeth as quickly as possible in order to determine what happens to the tissues around the apex. The animals which have died, I think, will furnish some interesting histopathologic material upon which I hope to report next year.

INTERCEPTION OF MALOCCLUSION IN CASES OF MULTIPLE LOSS OF DECIDUOUS TEETH*

By R. C. Willett, D.M.D., Peoria, Ill.

AT A MEETING of this Society held in Denver in 1910, Dr. Lawrence R. Baker gave us the results of the preliminary research work pertaining to "The Influence of the Forces of Malocclusion on the Bones of the Skull."

In the nineteen years since that meeting Baker has made valuable contributions to orthodontic literature by articles dealing with this important subject which have aroused and held my interest and have prompted me to experiment with methods and to devise means that may be applied in practice for the interception of oral deformities and malocclusion in cases where function has been seriously impaired through the premature loss of deciduous teeth.

The construction of partial or full dentures for children three years of age, with the expectation that they will adapt themselves to the wearing and use of such artificial substitutes for Nature's supplies, may seem visionary, and many may question the ultimate effect of such apparatus upon the growth of the jaws and associated structures. Nevertheless, we know only too well the complications involved in the treatment of cases at the later ages of eight and ten years when multiple loss of deciduous teeth has occurred prior to the eruption of the first permanent molars.

In view of our frequent encounters in practice, with the complications arising from such premature loss, I feel that there exists a compelling reason for seeking ways and means that shall at least modify the types of malocclusion and arch malformation attendant upon this cause, even though the means applied prove only partially successful in shaping the course of normal growth.

The three cases selected for this report have been taken from a group now under treatment and involve the outstanding complications that will be met in attempting to intercept malocclusion due to the loss of a number of deciduous teeth at too early an age. It is our intention to keep carefully checked records of these cases and by such records to determine, if possible, the effect which the applied means have had in the promotion of normal growth, as well as the measure of their efficiency in the interception of oral deformities.

Case 1.—This case is that of a little girl who was three and a half years old when, because of infection due to caries and systemic involvement, it became necessary to remove from the maxillary arch the first molars and the central and lateral incisors. From the mandibular arch the four molars were extracted, the operation resulting in the loss of ten deciduous teeth. Because of impaired function a cross-bite had developed, and the force of this malocclusion bearing upon the left maxillary deciduous canine had deflected that tooth lingually.

Following the correction of the malposed canine (Fig. 1-*A* and *B*), partial dentures were made. (Fig. 1-*C*.) These dentures gave the little patient service for more than two

*Read at the twenty-eighth Annual Meeting of the American Society of Orthodontists, Estes Park, Colo., July 15-20, 1929.

years. The mandibular first permanent molars were the first to erupt. Advantage was taken of their eruption and fixed space maintainers were made (Fig. 2). It will be noticed that the space maintainers made for the maxillary arch were constructed in two sections as a precaution against any interception of arch development if natural growth in the width of the arches occurred before the permanent incisors erupted.

The illustrations show the occlusion established and also that the eruption of the first permanent molars will, undoubtedly, establish normal occlusal relation. The change of form now taking place in the angle of the mandible is evidence that there will be no lack of vertical development.

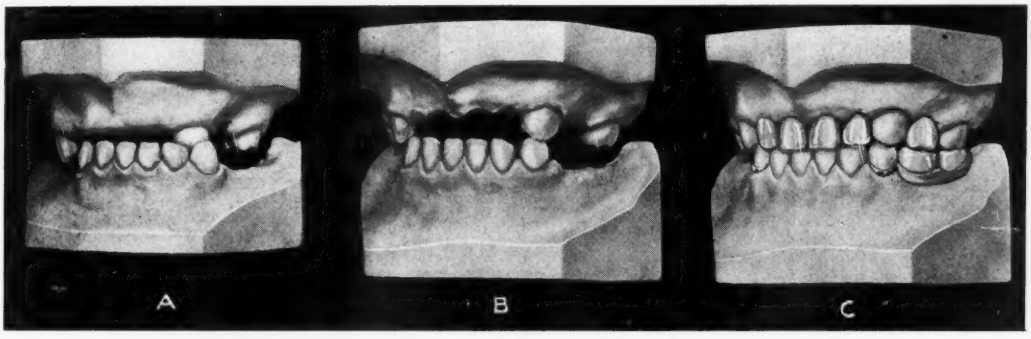

Fig. 1.—Multiple loss of deciduous teeth. *A*, malocclusion resulting; *B*, occlusion corrected; *C*, corrected occlusion as maintained with partial dentures.

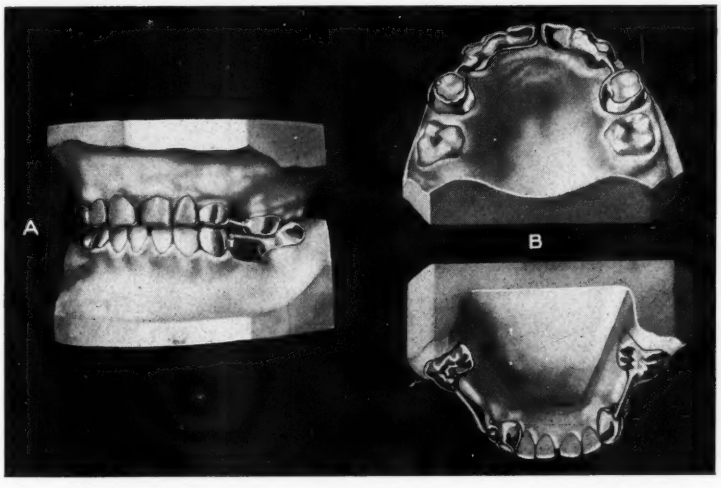

Fig. 2.

Case 2.—C. H. E. This is the case of a little boy who, when seventeen months of age, received a mouth injury which resulted in the complete loss of the mandibular deciduous incisors and the maxillary right central deciduous incisor (Fig. 3-*A*). Twenty-one months later, at the age of three years, the case was brought to our attention. A narrowing of the mandibular arch had occurred in the region of the missing incisors, estimated at about 0.1 of an inch, the width of an average sized deciduous incisor.

A Mershon appliance, of the lingual spring wire type, was adjusted and by this means the width of the mandibular arch was increased to what we considered normal dimension (Fig. 3-*B*). Through the forces of occlusion the maxillary arch followed the expansion of the mandibular one. The time required for completing this phase of the treatment was three months.

Following the development of normal width in the deciduous arches, the missing teeth were restored (Fig. 4-*A*). To make certain of as little interference as possible with any

natural development that might take place in the widening of the arches, a double track sliding device was placed on the lingual surface of the mandibular artificial teeth, the space maintainer being constructed in two sections.

The artificial teeth not only restored function in this case but are proving to be aids in the cultivation of proper speech. In the event that further orthodontic treatment is indicated before or after the eruption of the first permanent molars, appliances can be adjusted without removing the artificial teeth.

A complete description of the cast overlay technic applicable to anchorage of space maintainers, that were used in this case and the preceeding one, will be found in an article "Cast Overlay Technic and Its Application in Practice" read before this society in 1928 and published in the December, 1928, issue of the INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY.

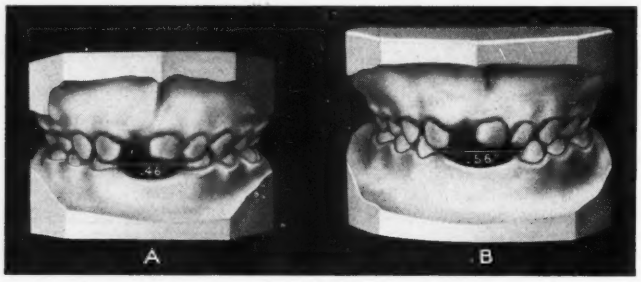

Fig. 3.—*A*, before treatment width of mandibular arch between canine teeth was 0.46 inch; *B*, after treatment width of mandibular arch between canine teeth was 0.56 inch. Width of arch between canines increased 0.1 inch.

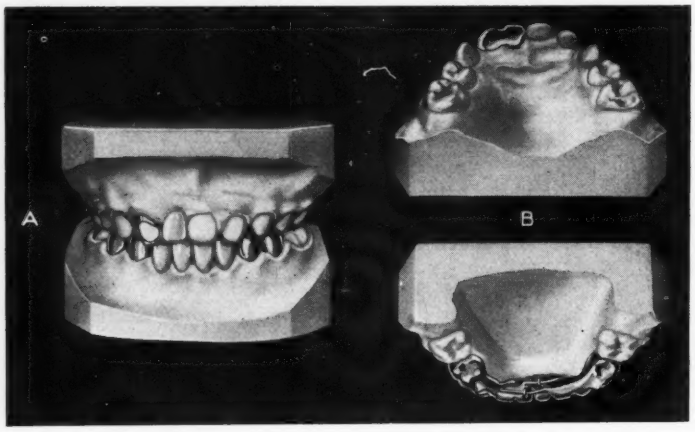

Fig. 4.

CASE 3.—In presenting this case it is desirable to bring to your attention certain complications which were the results of injury at birth, malnutrition, physical and mental retardation and premature loss of deciduous teeth. Before describing the methods employed in the restoration of function and the maintenance and promotion of vertical development of the jaws, a limited summary of the child's history, physical appearance and afflictions will be given.

B. M.—This boy, at the age of three years and three months, was brought under our observation by a public health nurse during the month of August, 1928.

Family History.—He was the first child, and the mother had been malnourished prior to the birth of the boy. A child born later was normal and of good health. A sister of the father was mentally deficient and intermittently an institution charge. The family history otherwise was negative.

Personal History.—The delivery was by forceps and the child's weight at birth was eleven pounds. Cerebral hemorrhage had occurred. He was nursed at the breast for five months, then, because of malnourishment of mother and child, breast feeding was discontinued and bottle feeding instituted. There was a paralysis of hands, lower limbs and feet. Rickets had developed early, and the spine had become curved. The teeth had begun to erupt at the age of five months, and it was reported to us that all of the deciduous teeth had erupted at about the same time, an unusual occurrence in so young a child.

History at Introduction.—The boy was anemic, his skin sallow in color, his eyes were dull and his tongue was coated. The lower limbs were stiff in the joints. The feet crossed

Fig. 5.

Fig. 6.

when in repose. The hands were like knotted bunches of tendon and bone, and the child was unable to sit or stand without support. The tonsils were hypertrophied, adenoids obstructed nasal respiration, and he was unable to talk.

The Teeth.—The function of the teeth had been lost. Caries had progressed until the pulps of all teeth of the maxillary arch and of the four molars in the mandibular arch were affected. Numerous alveolar abscesses were active. The six anterior teeth of the mandibular arch were free from caries.

These conditions afforded so little hope for the ultimate recovery of the child, and the demand for immediate relief was so great, that time was not taken for the making of complete accurate records of the entire physical condition. As a fact, in the maze of so many mental

and physical complications, there was no thought that this case could have in store for us anything of orthodontic interest.

The immediate extraction of the ten deciduous teeth from the maxillary arch and of the four deciduous molars from the mandibular arch was advised. This operation was performed on September 9, 1928. Following the operation an adequate diet was formulated and supervised by the public health nurse. On the day when the teeth were extracted the boy weighed eighteen pounds. During the next two months he made a rapid recovery, and when the case was again brought to our attention, he weighed twenty-seven pounds, registering a gain of nine pounds in that brief period.

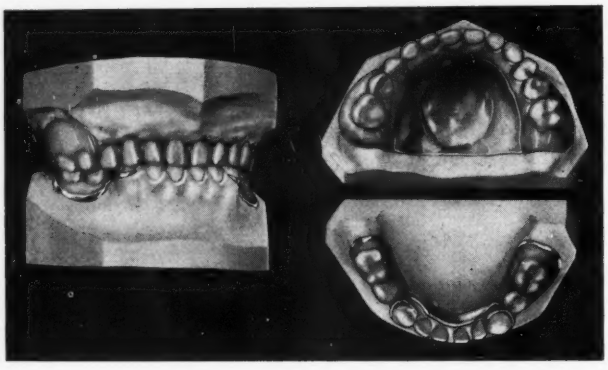

Fig. 7.

Fig. 8.

The physical and mental conditions of the little fellow were reversing from those he first presented to us. The stiffened joints had become somewhat flexible, the eyes were lustrous and observing, the skin was good in color, the mentality much improved, and the child showed a smiling cheerful countenance.

We were able to secure but one picture of the boy taken before treatment began, and that one was taken some eight or nine months previous to the rapid physical decline that seemed to warrant the radical action taken in the extraction of the fourteen deciduous teeth (Fig. 5).

A photograph of the child, taken two months after the extraction operation, furnishes the best evidence of the almost unbelievable change in his general condition, brought about through the elimination of focal infection and improved nutrition (Fig. 6).

But something more than an opportunity to give a limited humanitarian service had developed in the case. We found ourselves confronted with a real orthodontic problem of interest.

Teeth, of course, were important, but more important still was the maintenance and promotion of vertical growth of the jaws until the time for the eruption of the permanent teeth.

The impingement of the six anterior teeth of the mandibular arch upon the ridge of the maxillary arch was an irritating factor, and our first effort was directed toward the relief of this situation by means of a vulcanite base plate, with a groove cut, into which

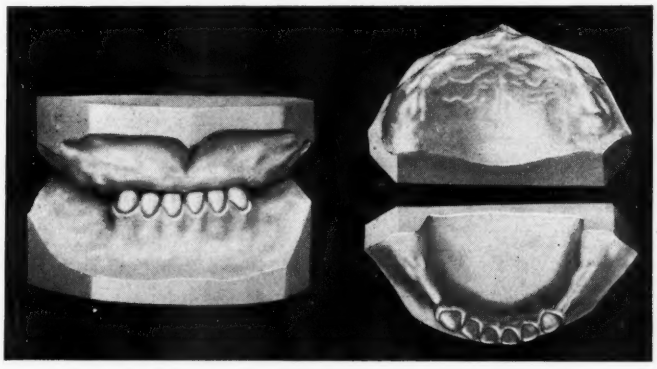

Fig. 9.

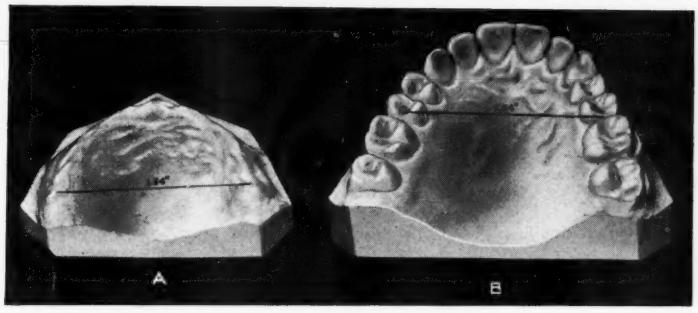

Fig. 10.

the mandibular incisors and canines could occlude. This vulcanite plate proved to be a great advantage, and the child was able to wear it without apparent inconvenience. It was a distinct aid to mastication.

One week later another plate was made, eliminating that part of the plate which had covered the labial surface of the gums as far back on the buccal surface as the region of the first deciduous molars. This second base plate proved even more serviceable than the first one.

The third step in the restoration of tooth function was the making of full upper and partial lower dentures (Fig. 7). The lower denture was the type of cast hard gold lingual bar to which the teeth were attached with condensite. Clasps fitted the canine teeth which had previously been covered with properly shaped overlays.

The upper denture was first made on a swedged steel base and later reconstructed on a thin cast gold base.

The little patient readily adapted himself to the use of these dentures; in fact, his only worry seemed to be that he might not get them back when they were removed from his mouth for cleaning.

Fig. 8 shows him as he looked a few days after the dentures were placed in his mouth.

Fig. 9 denotes that the dental arches are symmetrical and of proper proportions.

We have made a comparison of the boy's edentulous arch with that of a fourteen-year-old child whose arch is of average size and can be considered normal. The measurement of

the edentulous arch, in the region of the second deciduous molars, is exactly the same as that of the normal arch in the region of the second premolars—1.54 inches (Fig. 10).

December 15, 1928, the adenoids and tonsils were removed. A Wassermann blood and spinal fluid test was made at the same time and proved negative.

It has been difficult to secure pictures that would make suitable illustrations of the developing permanent teeth, but the ones that we have been able to obtain show that permanent teeth are in the process of formation, and in a perfectly normal way for a child of his age.

A comparison of the skeletal development of the patient's hand with that of a normal child proved interesting (Fig. 11). The picture of the normal hand (Fig. 11-*A*) was secured through the courtesy of Dr. Samuel Lewis. In this comparison there is no evidence of skeletal deficiency. (Fig. 11-*B*, the patient's hand.)

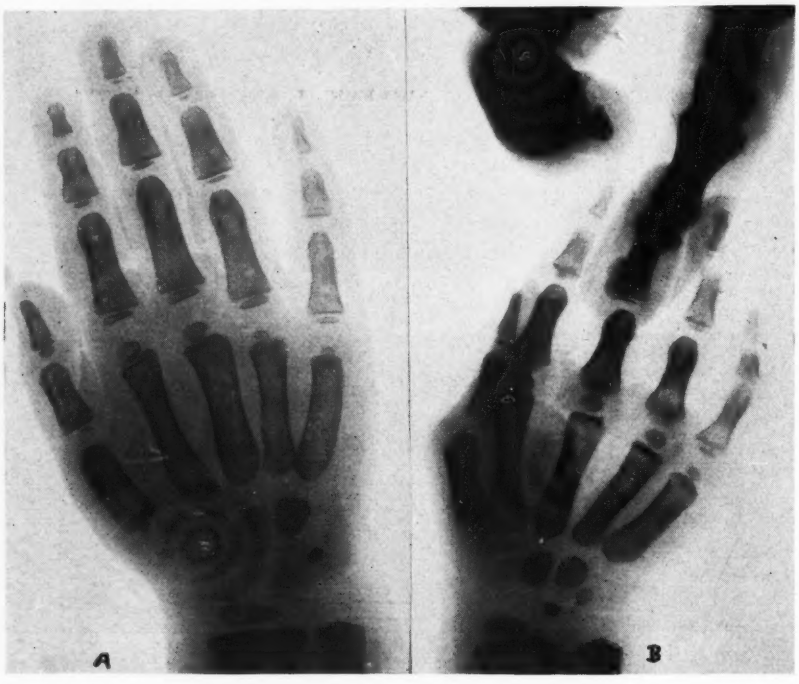

Fig. 11.

In the case of this boy, the mental and physical improvement has been steady up to the time of this report. The joints of the hands and fingers have become flexible, and there is evidence of marked gain in the coordinate functioning of the entire nervous system.

Dr. E. Z. Levitin, the neurologist who has had the case under observation, states that the general condition of this child may be classified as spastic diplegia, or, "Little's disease," involving both the upper and the lower extremities. Even though luetic data is indefinite in this particular case, lues must be considered as a possible cause of the condition. Dr. Levitin further says that, in his opinion, we can expect continued improvement only up to a certain level, at which the child will cease to progress and from which he eventually will retrogress.

While the future of this case is not very hopeful from the standpoint of the neurologist, if the present health and growth of the boy can be maintained until dentition is completed, the orthodontic treatment phase of the case will have been justified.

In concluding the report of the case, not credit only, but tribute is, herewith, given to our research workers, Howard, Lewis, Howe, Baker, and others, whose formulated principles of skeletal growth and of nutrition have been followed and applied to this particular problem according to our interpretation of them.

DISCUSSION

Dr. A. C. Rohde, Milwaukee, Wis.—On numerous occasions Dr. Willett has presented the results of his work before this and other societies, but I believe the three cases he has presented today are outstanding, because of the age of the patients, his technic and the excellent results obtained. He has done for these little patients what a great many men find difficulty in doing for adults.

Both research and observation have proved to us that function determines structure. The experiments of Baker and others have shown this.

It was this that prompted our essayist to devise means which not only would retain space when deciduous teeth were lost, but would restore function as well, so that the severity of the malocclusion which was almost sure to follow might be mitigated.

It was my good fortune to see the first case in Dr. Willett's office at a time when the little girl was wearing the partial dentures. It was really remarkable the way she had become accustomed to the use of them. I would like to ask why it was not advisable to use only the space maintainers in the maxillary arch supplying the incisors and first deciduous molars, instead of using a partial denture at the beginning?

The second case report emphasizes to what a great degree and in how short a time both arches contract due to the loss of deciduous teeth. The double track sliding device in the mandibular arch is ingeniously used, not only to restore function and facilitate speech but to allow for lateral development as well.

The cast overcaps which Dr. Willett uses with the occluding surfaces between are certainly a distinct improvement over the type of retainer with bands and wire. I have used a great many of these during the past year with gratifying results.

The third case report is to me the most remarkable, but I believe its real value lies in the future. To insert a full upper denture in a patient only three and one-half years old seemed to me impossible of success, but Dr. Willett has done it, and judging from the looks of the little patient he is thoroughly satisfied.

In spite of the many handicaps both physical and mental, the development of his jaws seems to be unusual. It is unfortunate that it was impossible to take complete records and measurements at the time when the patient was first presented for treatment. I believe that gnathostatic models and photostatic photographs would prove very interesting, even from now on.

Aside from the restoration of function, the wearing of the full upper denture and partial lower gives proper dimension to the face and establishes the normal position of the condyle in relation to the glenoid fossa.

While the prognosis of this case is unfavorable from the standpoint of the neurologist, I am sure this Society would appreciate a report from Dr. Willett in the future.

All of these cases emphasize again the general neglect of the deciduous teeth, on the part of both the dentist and the parents. Conditions are better than they were, but the progress of education is slow.

I believe articles of this kind should receive publication in the purely dental magazines as well as in our orthodontic journals, so that the general profession may know what should be done to intercept malocclusion when deciduous teeth are lost.

Before closing I wish to commend the essayist for his neatness and thoroughness and the excellence of his slides.

Dr. Clinton C. Howard, Atlanta, Ga.—It seems to me the most encouraging part of this presentation is the fact that we have listened to an orthodontist who has analyzed a condition further than just between the nose and the chin. To my mind it denotes progress in orthodontia. I believe in future years that men of Doctor Willett's caliber will prove to the orthodontic world that a knowledge of general skeletal growth has an intimate and valuable relation to orthodontic diagnosis and treatment.

When Doctor Willett spoke about the general growth of the child in connection with its type of arch deformity, he certainly indicates his belief that there exists a very definite correlation between the growth of the jaws and that of the body. I congratulate you, Doctor Willett, upon your depth of vision as well as upon your usual, characteristic thoroughness in presenting material before this Society.

Dr. Henry C. Ferris, New York, N. Y.—I wish to pay my compliments to Dr. Willett. I believe that few of us would have had the courage to place a full denture in a growing child's mouth because by so doing we would retard the lateral development of the arches, even though we are aware that this lateral development of the arches does not exceed 2.5 mm. in the deciduous second premolar region.

The value of an occlusion of the teeth and associated parts is most strikingly demonstrated in the record of these cases. All three cases will deserve careful study and observation. The last case I believe will prove to be a perfect success.

I disagree with the neurologist, because I believe his knowledge and experience are transcendent, based upon academic neurologic conclusions, such as central and peripheral impulses, "that do not run true to form." We see such illustrations in our daily practice, such as unilateral facial palsy at the time of the eruption of the mandibular third molars on the same side, which condition usually corrects itself without medication in three months as the tooth erupts.

The former is supposed to be the result of a peripheral brain disturbance, and the latter capable of producing reflexes to the central nervous system.

A reestablished function in a growing organism will accomplish more in the physiologic development of any growing organism than any medical student is capable of measuring.

I believe this child was suffering from an autointoxication from malnutrition, and it is reasonable to take this attitude because of lack of masticatory power and loss of functional stimulation of the salivary glands. The thyroid and parathyroid glands were likewise influenced through lack of stimulation of the blood through this dysfunction. As soon as the jaws were put in their proper relation to the whole head, muscular function increased, salivation of carbohydrates was immediately improved and the autointoxication was corrected, with the nervous system not excepted. The result proves these contentions. It will be extremely interesting to have Dr. Willett give us future reports on these cases.

Dr. Walter Hyde, Minneapolis, Minn.—It was my pleasure to see this boy last January. I want to tell you that in spite of all the unusual and extraordinary care with which Dr. Willett has prepared his paper and his slides you do not know the half of it! Never, in all my orthodontic observations, have I been so touched emotionally as I was by what I saw at that time. It really seemed to me as though it were the restoration of a whole individual; whereas, usually, we are interested in the restoration of the mouth.

The thing that touched me most was a sort of spiritual appreciation on the part of that child when Dr. Willett came into his presence.

I certainly hope we can have a further report on this matter.

Dr. Raymond C. Willett, Peoria, Ill.—I appreciate the attention the members and guests of this Society have given my report and the discussions by Drs. Rhode, Ferris, Hyde and Howard.

In reply to the question of Dr. Rhode as to why a fixed space maintainer might not have been applied to the mutilated maxillary arch instead of first supplying the missing teeth with a partial plate, I offer this explanation:

It seemed to me possible that due to the fact that the maxillary left canine had been moved from a lingual locked position, the removable partial denture would have less ill effect upon the osseous tissues than fixed retention. As long as the child got along so well with a partial denture which supplied the missing teeth of the maxillary arch, the making of a fixed retention was postponed until the time of the eruption of the first permanent molars.

If it is the wish of the members of the American Society of Orthodontists, I will be pleased to give illustrated reports of all of these cases at some future time, showing the changes that occurred in the growth and development of the dental arches and occlusion of the teeth through the influence of the methods of interception that were applied in these three particular cases.

ORGANIZING FOR PLEASANT AND EFFICIENT PRACTICE*

By James D. McCoy, D.D.S., and John R. McCoy, D.D.S., Los Angeles, Calif.

THE title of this discourse may perhaps prove misleading to some, for doubtless the impression may have been given that it will deal more with the economic side of practice than with its other phases. In a way, this is true, but not to the extent that it will be concerned with the dollars and cents side of our work, but rather with the more important factors which make it possible for us to serve our patients well and under conditions which make for efficiency and lessened stress to all concerned.

Most practitioners have their ideals of what an office and its equipment should be like, but I fear that in the vast majority of instances their dreams never come true, and they go on working from year to year under conditions which not only handicap them in the quality of services rendered but also subject them to discomforts which are undeserved. It happens that we have been fortunate enough to realize a lifelong ambition and establish ourselves in an office which not only has every convenience, but also constitutes an environment which is stimulating and pleasant.

There are many advantages where two practitioners can associate themselves together and live on terms of peace and perfect understanding. Sad as it may seem, this state of affairs has never been realized in any large number of instances. With us, it has always proved highly advantageous, and for that reason in planning an office we could take advantage of certain conveniences, such as an x-ray room, laboratory, office personnel, etc., which could be shared by both of us without inconvenience to either, and thereby save the necessity of duplication.

Many of us have moved from one office to another and have striven with each change to add improvements. Something over three years ago, we made what I hope will be our last move. Having spent twenty years in the exclusive practice of orthodontia, with a location in the metropolitan business district, we decided upon a rather radical change, and moved our offices into the residence district at a location something over five miles from the center of the city. Many of our friends told us we would regret the move, but we have never had reason to do so. So far as losing any practice is concerned, we have never lost any. The fact is that while we were conducting a full practice before we moved away from the central district it has not decreased in volume since the move but has increased materially in quality.

Southern California was originally a Spanish possession and its early history is frequently reflected in its architecture. The building we are in is Spanish in its architecture and coloring, and the same feeling has been carried into the office to a certain extent.

*Read by Dr. James D. McCoy at the twenty-eighth annual meeting of the American Society of Orthodontists, Estes Park, Colorado, July 15-20, 1929.

Fig. 1 shows the floor plan of the office which occupies the entire third floor of the building. Upon leaving the elevator, you enter a small lobby and come directly to the reception room doors. Passing through these, you enter a rather commodious room (Fig. 2). It is well lighted, and its furnishings and decorations give warmth of color and an inviting atmosphere. A large oriental rug covers the floor, the background of which is a dark blue with its figures in gold and maroon. This same color scheme, to a certain degree, is repeated in the stenciled ceiling, and the drapes surrounding the generous windows are maroon in color. The furniture is Spanish in feeling and covered with materials which give life and warmth to the room. In other words, we have made an effort to get away from the cold atmosphere that pervades many dental and medical reception rooms, and we have undoubtedly succeeded. Turning to the left after entering the door you face the secretary's lobby (Fig. 3). From her

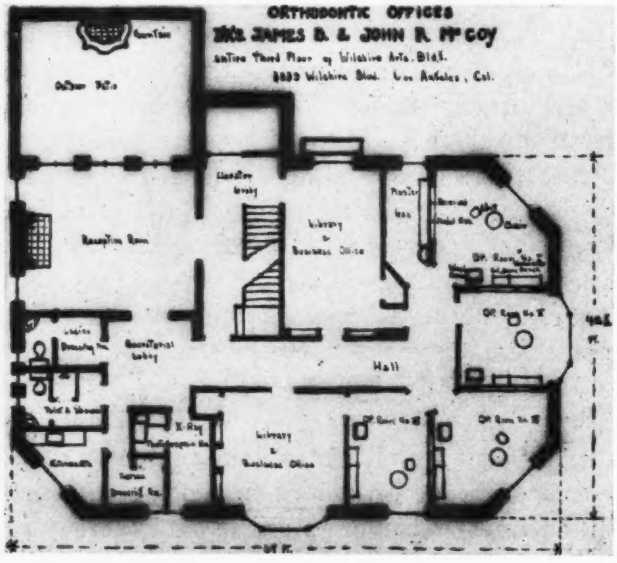

Fig. 1.—Floor plan showing the general arrangement of the offices.

position behind the desk she can see anyone who enters the room and with a system of intercommunicating telephones, each patient's arrival is communicated to the operating suites.

Looking to the right, through the broad French windows of the reception room, you look into the patio (Fig. 4). This in reality is part of the reception room, as the doors opening into it are rarely ever closed. The garden is very colorful, not only from the standpoint of its tile covered wall, the colors used in the fountain and its tile covered floor, but also in the many potted plants and flowering shrubs which it contains.

Adjacent to the secretary's lobby are dressing rooms and toilets for both boys and girls, a dressing room for the office employees and a kitchenette where they may prepare their lunches if they so desire. We also find this advantageous on occasions when we desire to give dinners in the office, the general atmosphere of which lends itself for purposes of entertainment. On more than one occasion it has been our pleasure to have as guests distinguished members

of our profession and also to entertain our local Orthodontic Society. On such occasions we usually do the "chefing" ourselves, and they say that a good time is enjoyed by all.

From her position behind the desk, the secretary not only has a full view of the reception room but also may look down the corridor which leads to the business offices (Fig. 5) and the operating suites. This is a rather wide hallway, in which the same color scheme is carried out as used in the reception

Fig. 2.—The reception room.

Fig. 3.—The reception room and secretary's lobby.

room, with the exception of the floor covering, which is a neutral carpeting. The first door to the right brings you to one of the business offices, or libraries (that of Dr. John McCoy). This is rather a large room with ample lighting, a corner of which is shown in Fig. 6. Across the hall from it another such room is located (library of Dr. James McCoy) two views of which are shown in Figs. 7 and 8. These rooms have ample space for books, filing cabinets and all other things which add to the efficiency of a combination business office and library. Each one has an ample divan, upon which one may lie in a state of perfect relaxation and comfort. We make it a practice each day after lunch

to sleep for thirty minutes before we start upon the afternoon's work. As the windows are covered with Venetian blinds it only requires a moment to shut out the light, and this done, it becomes an easy matter to relax and sleep. Personally we know of nothing which adds more to our efficiency than this

Fig. 4.—The patio as viewed from the reception room.

Fig. 5.—The hallway leading from the secretary's lobby to the operating suites and business offices.

daily period of relaxation. Very young men may not need it, but after "standing the gaff" of orthodontic practice for any number of years, those who will give it a trial will find it profitable from every standpoint.

The hallway from the secretary's lobby opens up at its end into rather a commodious foyer into which all of the operating rooms open, as does also the

laboratory. By referring to Fig. 1, this arrangement is easily seen, and Fig. 9 also gives an idea of the plan.

Each of us has two operating rooms, and in each instance these are located in close proximity to our library and business office. Figs. 10 and 11 show typical operating rooms. These all have ample outside light; in fact, this condition prevails with each room in the office, which not only saves eye-strain, but contributes materially to the proper ventilation of the office as a whole. Going

Fig. 6.—One of the business offices or libraries.

Fig. 7.—View of the other library.

back to the operating rooms for a moment, first let us consider the matter of floor coverings. We have used rubber tile and find it a great improvement over anything else thus far experienced. It is far more attractive than linoleum and vastly superior, from the standpoint of comfort, to hard tile. Those who stand on their feet all day long are pleasantly surprised at the relief they get out of this shock-absorbing material.

The operating cabinets (see Figs. 10 and 11) were built after our own design by the American Cabinet Company and have a height which encourages good posture. You will notice that they have broad working surfaces, with a

place for everything you use most frequently. They are well supplied with drawers and storage space.

You will note that we use dental units which carry an engine, spray bottles with heater, emergency light, bracket table, compressed air, saliva ejector, water and cuspidors. We still believe orthodontic patients should have cus-

Fig. 8.—Another view of the room shown in Fig. 7. (Note the divan used for the daily siesta.)

Fig. 9.—Foyer opening into operating rooms.

pidors to spit in. Perhaps we are old-fashioned. There is a so-called ultra-modern group of orthodontists in our community who do not believe in the use of cuspidors. One of their leaders wrote an article in which he condemned them as being filthy and urged his followers to use as a substitute a beautiful Japanese bowl, partly filled with water with a few rose leaves sprinkled in it and held by the assistant under the patient's mouth. (Laughter.)

On the right side of each operating room there is placed a piece of equip-

ment which is most helpful (Fig. 12) and contributes very materially to the efficiency of the day's work. This is a combination soldering and technician's bench. It has a dental engine mounted upon it which may be used by the operator for polishing appliances, or the technician may sit at her bench and utilize it for the same purpose. You will note that a dual foot control is provided, which in itself is a time saver. The top of the soldering bench portion

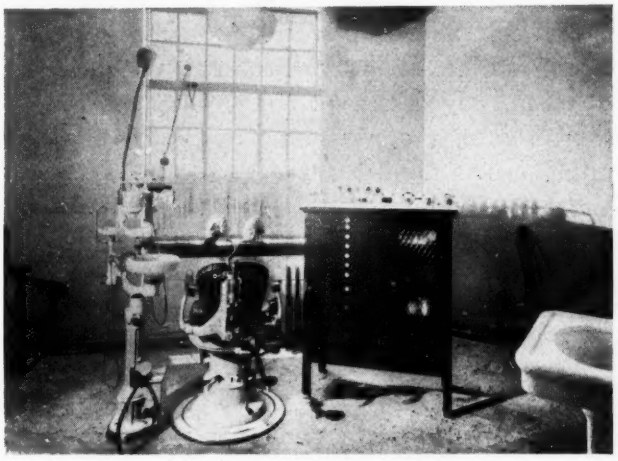

Fig. 10.—Typical operating room.

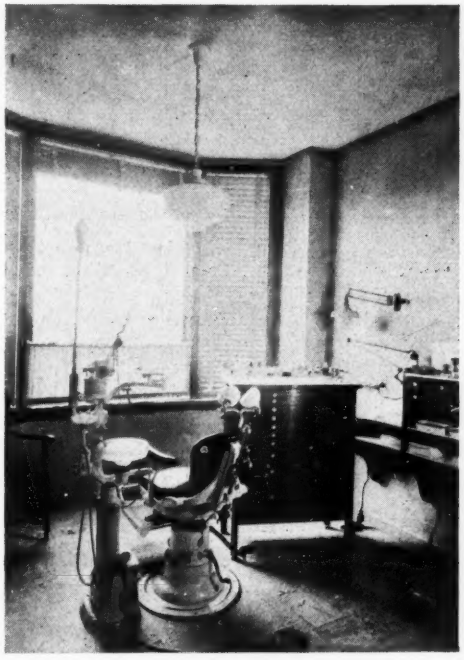

Fig. 11.—Another operating room. All four of these rooms have almost identical furniture and equipment.

is placed at a height enabling the operator to stand in an easy position and solder his appliances with a minimum degree of eye-strain or posture discomfort. Upon one end of this cabinet is attached a modeling compound water heater. This is thermostatically controlled so that modeling compound is always available for use. It is placed at a height where you can step up and take out just the amount you desire and proceed with your impressions. Of

course, there are some orthodontists who do not believe that accurate orthodontic impressions can be made with modeling compound, and they are still subjecting children to plaster impressions. We feel very sorry for these orthodontists and even more sorry for their patients. (Laughter.) We have not taken a plaster impression in our office for over fifteen years. Adjacent to the wall cabinet, the wash basin is located, whose only unusual feature is the foot pedals which control the water. This means that the hands do not have to be soiled by turning off a contaminated faucet.

Before leaving the subject of the wall cabinet, which we have indicated as a feature contributing greatly to the efficiency of the office, let us mention just briefly the manner in which our technicians assist at certain times. If we are making applicances, a band is fitted and then handed to the technician who goes to her bench and solders it. While she is doing this, the operator is fitting another band. After each band is soldered, it is put back in the mouth

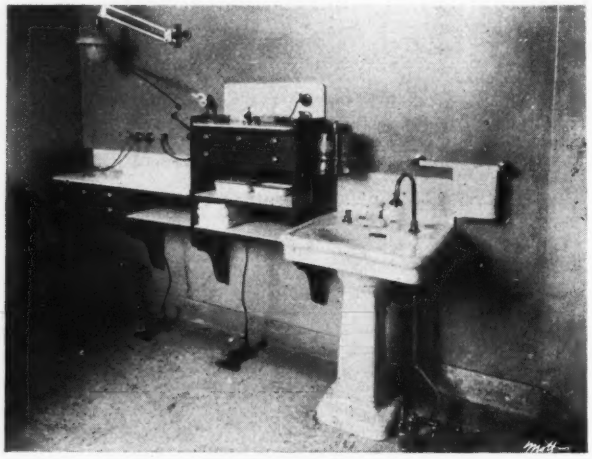

Fig. 12.—Combination soldering and technician's bench.

for a final fitting and then taken by the technician and polished. In this way an operator is saved time and effort which can be expended elsewhere with profit.

During the busiest part of the day, which of course comes after school hours (and we want to say that after school hours is the curse of orthodontia), when we have to carry the peak load of our work, a patient is placed in each room and made ready for treatment. As fast as one is finished up it is merely a matter of walking into the next room, washing your hands and going to work. With the completion of each case, the rooms are cleaned up and a new patient brought in. These routine changes are all made by the nurses working in conjunction with the secretary, and because of our intercommunicating telephones and system of signals can be brought about with a minimum amount of confusion. After each patient is finished he goes to the secretary for his next appointment. All we do is to indicate to them whether we wish to see them again in one, two, three or four weeks. The secretary takes care of the rest of it and thereby saves us much time which would be occasioned by discussion with mothers who have other engagements and find difficulty in arranging orthodontic appointments.

One room adjacent to the operating suites which has not yet been mentioned is the laboratory. This is one of the very pleasant rooms of the office and is equipped with every facility which aids in making the efforts of our assistants effective. This room is shown in Fig. 13. On the left side of the room is a large storage cabinet, on the top of which is a polishing lathe where appliances may be cleaned and given a high polish. Beyond this, on the same side of the room, is a plaster workbench where impressions are cast. This bench is made just the right height so that a technician can stand and cast impressions to advantage. For diagnosis we use gnathostatic models which, of course, reduce the time and labor necessary in making our casts. Most men do not realize that this method saves both time and labor when its technic is once understood. On the other side of the room you will note a bench where models are trimmed and other laboratory work is carried out. It is of a height

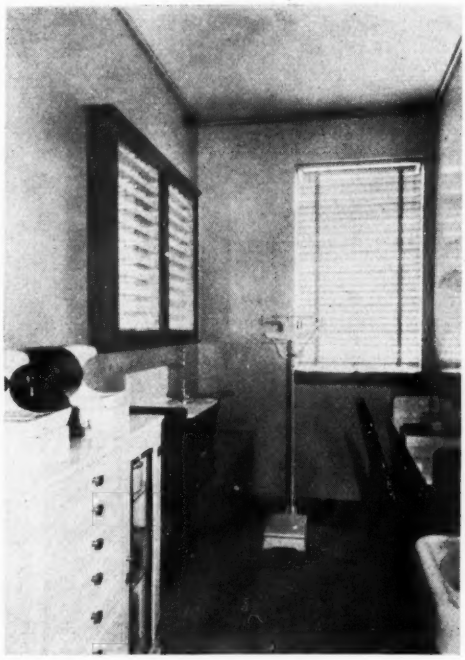

Fig. 13.—The laboratory.

which makes it possible for the girls to sit down while working. There is a place for two girls to work and all facilities, such as instrument drawers, plaster bins, etc., are duplicated. Several other conveniences are also located in this room, such as a scale for weighing patients and keeping a record of their heights, etc. The door to this room is never closed. In fact, all the doors leading into operating rooms and the libraries are usually left open which gives a pleasant spacious atmosphere that is very wholesome.

One room not yet mentioned is the x-ray and photographic room, which is shown in Fig. 14. By referring to Fig. 1, you will note that it is located at one end of the hall but, even so, it is easy of access. Without fuss or previous preparation, it is possible for us to take our x-ray pictures and also our photostatic pictures. A dark room is connected with solutions always ready for use, so that our photographic and radiographic problem is made easy and pleasant.

You will note that we utilize a rather unique photostatic outfit which we have developed ourselves. A counterbalanced x-ray tube stand has been used to carry the camera and focusing beam. This gives a very stable and easily adjusted base upon which to carry these pieces of apparatus. Artificial light is employed in the form of a 500 watt lamp which is likewise attached to the same stand. This is placed in a definite relationship to the camera so that our light values remain constant. We believe that anything which adds to the interest of our daily work will tend to increase our efficiency and make it possible to render better service to our patients. With this idea in mind more than one feature has been added which might not be desired by the average practitioner, these being more or less individual in character. We believe, however, that the general plan of the offices, as an arrangement for two men will be generally appreciated.

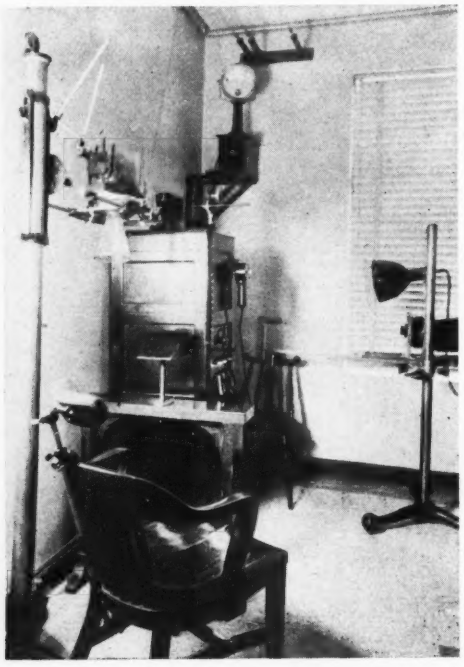

Fig. 14.—The x-ray and photographic room.

One of the difficult problems in orthodontic practice is that concerned with organizing our time so that the full day may be utilized. Most parents and school-teachers seem to think that the period between 3:30 and 5 o'clock should be sufficient to provide all orthodontic services. For more than twenty years we have struggled to re-educate people along this line, and while we have frequently been discouraged, some progress has been made. The hours from nine to twelve in our offices are utilized for long appointments, such as are necessary in starting cases or in doing special work occasioned by changes in appliances, etc. The hour between 2 and 3 is reserved for consultations. This means that children must be kept out of school for this purpose. We never refer to this professional service as "examination" and constantly refuse to see people who have such a low appreciation of our specialty that they are not willing to come to us during this hour for consultation. A nominal fee

is charged for this service which includes an oral examination, the taking of a case history, radiograms, when necessary, and sometimes casts and photographs. The hours between 3 and 5 o'clock are given up exclusively to routine

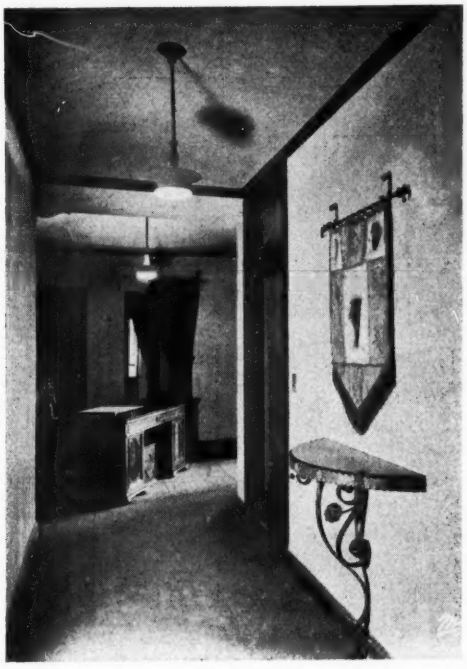

Fig. 15.—The secretary's lobby viewed from the operating suite.

Fig. 16.—The building in which the offices are located.

treatment appointments, as are also the hours between 9 and 12 o'clock on Saturday mornings. The office is closed on Saturday afternoons. We do not want to give the impression that our offices are elaborate, for doubtless there are many who have expended a great deal more in fitting up than we have.

What we have done is to put a great deal of thought into every room, every piece of furniture, and every item of equipment, so that the whole can be utilized in a manner to make our working hours more pleasant and our efforts for our patients as beneficial as human limitations will allow.

DISCUSSION

Dr. B. Frank Gray, San Francisco, Calif.—Dr. McCoy has given you a splendid description of the offices occupied by himself and his brother, Dr. John McCoy. I have had the good fortune of being in those offices many times, and I can commend to you the layout. What will be best will be your own personal observation of these offices whenever opportunity presents itself to visit Los Angeles.

Dr. McCoy has the very good fortune of having a brother who is quite a financier and capitalist, and that is some advantage. He didn't say to you, which I will, that the building itself is owned by one or both of the McCoy brothers, which is possibly another advantage. (Laughter.)

Really, these offices make a most beautiful impression. The color schemes, as Dr. James has pointed out to you, are really splendid. When he was presenting his slides, I thought they might give a truer impression if they were tinted, yet the colored slides are usually exaggerated in one way or another and possibly do not convey the right idea.

It is not only the arrangement of these offices but the work that is being done in them that appeals to me. For instance, Dr. McCoy speaks of his work with modeling compound. I have noted the work he has been doing with this material for a number of years. I have been using the modeling compound impression trays myself with a very great deal of satisfaction. Those of you who feel that good models cannot be produced through the use of modeling compound will do well to inspect some of Dr. McCoy's models, and you will see how beautifully they are made. This method effects a saving in time and simplifies the model work in the laboratory. But of still greater importance, this method is far more pleasant for the child patient.

Dr. McCoy's arrangement for his x-ray work is splendid. You will note from some of the work that he presents from time to time how beautifully he has worked this out, and the character of x-ray work he does. Of course, he and Dr. Ketcham have been pioneers in this work. Their efforts have certainly not been in vain.

One note that I think is in evidence in visiting the offices is to see the simplicity with which everything is conducted. There is no lost motion or energy.

I think if I were outfitting an office anew, I would not use, as I believe the Drs. McCoy have done, the white chairs. I believe they are a little glaring. I think some of the soft colors that are now available, possibly in grays or some modified tint, are very satisfactory.

That recalls the offices of a friend of mine in Los Angeles (an oral surgeon) who established an office in which he used gray tones, even to tiling the floors and walls of his operating rooms. It is really very beautiful and very easy to keep clean.

Again, I have always doubted if I would use the "units" in my operating room if I were establishing new offices. I think that is a departure from the simplicity we like to maintain, with as great an absence of the appearance of machinery about us as may be practicable.

The patio he spoke of is an attractive adjunct to an office where one can arrange it. A short time ago I was thinking that one situated, as we are, for instance, in a large downtown office building in San Francisco, might arrange with the owners of the building to have a little bungalow structure built on top of the building, if elevator facilities could be arranged. As for the layout, one could have most everything he might want right in the center of a great city. This idea is suggested as a possibility for some of you who live in large cities, and who might possibly prevail on the owners of large office buildings to help you work out some such plan, thus obviating the requirement of moving into the outskirts or residential section of your city.

However, in Los Angeles such a location as the Drs. McCoy have chosen, is most desirable. You will appreciate this when you visit Los Angeles and see the development of

the city and the layout of all the environs in that particular direction. I remember, not so very many years ago, of riding horseback through that immediate district when practically open fields predominated in that part of Los Angeles.

Dr. McCoy spoke of the flowers, shrubs and birds in the patio. I can vouch that they have all those. They probably have the omnipresent mocking birds come in and help tune up!

Dr. G. W. Grieve, Toronto, Ontario.—I should like to add a word of appreciation for the presentation of Dr. McCoy. It is a most delightfully laid out office. I am sure everything is as beautiful as it appears on the screen.

One point that I noted particularly was the use of impression material. I have no doubt that Dr. McCoy is very expert with it. I see he is on the program for a clinic, where we will have an opportunity of seeing his technic.

I have seen very beautiful casts made from a new impression material called Dentocol. I know you will all be very much interested in seeing it. Dr. Denbo is going to present that here in some form, and I may say that the best casts I have yet seen made from plastic material are those made from Dentocol. You will find it is very much like compound in its use, and they say it is quite pleasing to the patient. There is no "drawing" of the material. You really get very beautiful impressions.

I have no brief for advertising this material. That is farthest from my mind. I know you will all be glad to see it, and perhaps appreciate its value as I have.

Thank you very much. (Applause.)

Dr. James D. McCoy, Los Angeles, Calif.—I failed to emphasize one feature of the office, although it frequently contributes materially to our comfort and pleasure. The kitchenette has a stove and all the dishes and silver necessary to serve eight people. We convert the reception room into a dining room by moving the big Spanish table to the center. On such occasions I am the chef.

I do not know anything about cooking, but my brother is a great physiologist and helps me out. He mixes things together before dinner and gives the mixture to the guests. It is a sort of tonic we have out there. (Laughter.) After they have had four they do not know whether they are eating or not. (Laughter.)

There is one thing in connection with organization that I want to emphasize, and that is the matter of appointments. I did not dwell upon it, but I think it is one of the very important things affecting our work. We never see patients for consultation or for special work except between certain hours, and never after school. Schools are in session most of the day. If you take one patient for consultation after school hours when "you are carrying the peak load," you can easily wreck an afternoon. As already stated, our hour for consultation is between two and three by special appointment.

I did not mention the fact of the ownership of the building because my brother is a very modest young man, and he does not like to talk about it very much. I am just one of my brother's poor relations and one of his hard-working tenants, but I should like to give this word of advice to you orthodontists: If you want to practice pleasantly and efficiently, choose your brothers with care. (Laughter.)

I do not want to give anybody the impression that our office is elaborate. It is not. I do not mind telling you that in spite of the fact that we have twelve or fourteen rooms equipped with everything that makes practice pleasant and efficient, the total amount of capital invested in that office would probably not exceed $12,000. A lot of you have offices in which you have probably invested that much money, if not more. It isn't the amount you put in; it is the thought back of it that counts.

I also forgot to mention the color of the operating rooms. We have tried to work out a color scheme that would react pleasantly upon our patients and in consequence use a nice warm gray upon the walls and a similar color in the tile floors. We have mahogany woodwork and doors, and everything in the operating room, with the exception of the chairs and units, is a soft brown mahogany. These are white, but there isn't enough white in the room to prove offensive; just enough to look refreshing. (Applause.)

PHYSIOLOGIC DIAGNOSIS

A Key to the Regulation of Complex Malocclusions

By Bernard L. Hyams, D.D.S., Montreal, Canada

IN THE regulation of malocclusions, the aim of the orthodontist is to establish a self-retaining normal occlusion. Now the cardinal fact in the entire realm of orthodontic therapeutics is the property of a bony structure to alter its form readily, in response to changes in the nature of the forces to which it is subjected.[12] When a malocclusion has been corrected, the bony structures supporting the teeth are still subject to the same physiologic laws that enabled the regulation to be effected. Should the identical forces persist that caused the malocclusion in the first instance or contributed to some of its associated defects, they will surely duplicate the original condition as soon as they are allowed to exert their influence.

The etiology of mesioclusion, distoclusion and lateral underdevelopment of the dental arches frequently involves constitutional disturbances and possibly congenital and hereditary influences, and must often be admitted to be indefinite in specific cases. Many other deviations, however, such as excessive overbite, protruding maxillary anteriors, and drifting in connection with a break in the continuity of the arches, may be experimentally produced. For the purpose of aiding in their prevention and correction this work presents the known etiology of many types of malocclusions, and methods for their examination and diagnosis.

Malocclusion is a deviation from the normal to such an extent as to interfere with the functions of the teeth.[3] The conventional classifications of malocclusions are based on variations in the positions of the teeth and more or less of their supporting bony tissues.

Angle's[1] and Lischer's[9] classifications consider the teeth and only their immediate supporting tissues, and are explicit in regard to the anteroposterior relation of the dental arches, but the consideration of other vital deviations is neither definite nor methodical. Considering the fact that the diagnosis of a malocclusion should automatically outline its plan of regulation, and in view of the fact that every defect must be corrected before regulation can be considered finished, these classifications are far from satisfactory from the practical aspect.

Simon's[11] classification covers a more extensive osseous field, and methodically examines morphologic variations from the greatest to the most minute degree.

All these classifications fail, however, to give information of essential functional abnormalities, and also of any etiologic significance attached to the individual deviations, information that is indispensable from the practical aspect.

When malocclusions are contemplated from the viewpoint that they are essentially morphologic modifications, there is a tendency not only to regard the masticating apparatus as a permanently rigid structure, but also to place the regulation of malocclusions on a strictly mechanical basis.

Now the definition of malocclusion permits reference not only to structural variations in the denture, but also to any functional disturbance that has a bearing on a structural maldevelopment. Special distinction is also permitted of a deviation in form or function, the occurrence of which is responsible for additional consequent morphologic modifications. In individual cases this provides a truly logical diagnosis that conduces to the rational correction of many involved malocclusions. It has previously been acknowledged that a bony structure responds to changes in the nature of the forces it sustains by altering its form. This being the case, it is of great practical value to recognize the deviational influences or local etiologic factors that are capable of inducing modifications of the masticating structure to such an extent as to interfere with the functions of the teeth.

These deviational influences or local influences to malocclusion are arranged in three separate groups.

In the first group are included the natural eruptive force of the teeth, the anterior thrust of development, the posterior thrust of the lips and atonic lips.

In the second group are mouth-breathing, thumb sucking, lip interposition, tongue biting and enlarged frenum labii.

The third group comprises lateral underdevelopment, distoclusion and neutroclusion with posterior relation of the mandibular anteriors, and mesioclusion and neutroclusion with either anterior relation of the mandibular anteriors or posterior relation of the maxillary anteriors.

In the fuller treatment of the members in each group, the specific deviations connected with each deviational influence are distinguished, and the order of arrangement employed serves to elucidate the details of many involved malocclusions.

Group 1.—When the dental apparatus is intact,[1] the natural eruptive force of the teeth tends to secure and maintain occlusal contact between the teeth of both arches;[5] the forward thrust exerted on the posterior extremities of the arches until the end of the developmental period especially,[6, 3] the limiting force of the lips exerted on the labial surfaces of the teeth and capable of transmitting a posterior thrust on the teeth of both arches,[10] all balance each other so as to maintain the normal form.

If for any reason a break occurs in the continuity of the arches, this equilibrium is disturbed, and these identical forces coming into play under the changed conditions, proceed to alter the form of the denture until a new state of equilibrium is reached with respect to the forces acting under the altered circumstances. The following changes generally occur in this process: When a tooth is deprived of its occlusion, the latent eruptive force can be reasonably depended upon to elevate it above its original plane until some occlusal contact is attained.[5]

When the continuity of the arch is broken, the teeth on each side of the space drift together in response to the forward thrust of development on its posterior extremities and the posterior thrust of the lips on its anterior surface.

When the support on the posterior extremities of the arch is cut off from the mandibular teeth by a break in the arch, they collapse posteriorly, occlusal contact being lost. As a result, the maxillary and mandibular anterior teeth tend to erupt in an effort to restore their occlusion. This is a common origin of excessive overbite.

When the lips have failed to develop their proper tone, the maxillary anterior teeth and occasionally the mandibular anterior teeth are frequently displaced anteriorly by the pressure of the tongue. The result is then identical with other conditions where the continuity of the arch is broken.[5]

In connection with the occurrence of excessive overbite, not all overbites are caused by this overeruption of individual teeth. Milo Hellman has shown that up to the age of eight years, the anterior region of the denture develops vertically in advance of the posterior region, while between the ages of eight and sixteen years, the posterior region develops at a greater rate than does the anterior region, so as to equalize the vertical development of the entire denture.[7]

In these cases many deviations occur, such as crowded mandibular anteriors and protruding and separated maxillary anteriors, as the erupting anteriors accommodate themselves to the existing conditions. The treatment indicated for this condition differs entirely from that indicated for overeruption, the rational procedure for the former being to disregard it until the age has passed when it is assured that the natural development will not correct it and its associated deviations.

Bodecker[2] inclines to Robinsohn's theory that the overeruption of teeth and their drifting are strongly influenced by the endocrine system. Even when a tooth loses its antagonist, it does not necessarily overerupt but will act in accordance with stimulation arising from the endocrine secretions. Similarly in mutilated dentures, the teeth drift or maintain their positions to a great extent according to the dictates of the endocrine system.

This is the context of Robinsohn's theory as it applies to practical orthodontia. This important consideration demands recognition in the field of preventive orthodontia. In the diagnosis of malocclusions, cases are considered for the most part in which such overeruption or drifting has already occurred. When considering infraocclusion or incomplete eruption of teeth, however, this theory often indicates mechanical interference rather than the common procedure of allowing nature to complete the process.

MOUTH-BREATHING

Group 2.—The play of atmospheric pressure is removed from the floor of the nose and the nasal sinuses when breathing takes place habitually through the mouth, and the failure of the palatal vault to develop downward may frequently be attributed to this cause, and this in turn may produce a deflected

nasal septum. Furthermore, the lack of support for the mandible in the absence of suction tends to cause a general anterior underdevelopment of the mandible.

In addition, atonic lips associated with mouth-breathing permit the anterior displacement of the maxillary anterior teeth, and in this event the eruptive force of the teeth tends to elevate the maxillary and mandibular anteriors, causing an excessive overbite.

Then, the mouth being continually open, the muscle bands of the cheeks also exert a constant contractile influence on the maxillary arch, inducing lateral underdevelopment.[4]

THUMB SUCKING

The interposition of a finger between the arches for a long period of time introduces a force for which no counterbalance is provided. Eventually, therefore, the denture alters its form to accommodate the intrusion, until equilibrium is again established. This deviation generally takes the form of an anterior displacement of the maxillary anteriors. In addition, a constant interference with the anterior development of the mandible is offered, tending to produce distoclusion, and the disturbance to the arch form by displacing the anterior segment is a positive influence toward lateral underdevelopment. Then, as their occlusion is lost, the maxillary and mandibular anteriors overerupt, producing an excessive overbite. Furthermore, the mechanical separation of the lips caused by this deviation tends to break the seal of the mouth, inducing mouth-breathing and the long chain of deviations associated with this influence.

At this stage, should the lower lip become interposed between the arches, it forms an effective seal, assisting in the maintenance of nasal breathing. The increased size of the new intrusion, however, causes a further alteration of the structure, until it is accommodated and equilibrium is again reestablished, with the anterior displacement of the maxillary anteriors, posterior displacement of the mandibular anteriors, and the other associated deviations.

LIP INTERPOSITION

When malocclusions are encountered in which all the deviations are directly attributable to the habit of interposing the lower lip between the dental arches, the process is similar to that described under thumb sucking where the lip is interposed and nasal breathing is maintained.

TONGUE BITING

The habitual insertion of the tongue between the anterior teeth introduces a deviational influence similar to that of thumb sucking or lip interposition, with the result that to accommodate it and reestablish equilibrium, the teeth are forced to occupy positions that do not permit them to occlude. This is a common cause of open bite.

ABNORMAL OR ENLARGED FRENUM LABII

The presence of an enlarged frenum sets up an unbalanced force which requires a modification of the form of the denture before equilibrium can be

established. The required space between the central incisors is gained by some form of crowding such as rotations or impactions.

GROUP 3.—In the final group are included a series of deviations, the etiology of which is uncertain at the present time. Mesioclusions, distoclusions, lateral underdevelopment and anterior underdevelopment of the maxillary arch or of the mandibular arch with neutroclusion, are frequently observed which can be attributed to no definite cause. The practical purpose of a diagnosis is to trace all abnormalities to their furthest reducible cause. In such cases, while they are actually only signs of more fundamental abnormalities, our diagnosis must rest with their distinction because of the limited understanding of the times. On the other hand, because it can be shown that these conditions are responsible for the occurrence of other deviations, they may be considered to possess primary significance with regard to the latter.

The first deviation treated in this group is lateral underdevelopment of the arches. When the dental arches fail to develop sufficiently to accommodate the permanent incisors, these teeth are forced to crowd or rotate, or to occupy positions anterior to their accustomed positions for even alignment. In addition, any tooth that is crowded out of occlusion tends to erupt beyond the regular plane.

In distoclusion or neutroclusion with the mandibular anteriors occupying positions in the mandibular arch posterior to the normal, we find that the maxillary and mandibular anteriors tend to overerupt, producing an excessive overbite. Where normal nasal breathing is present, and the lips are well developed, the maxillary anteriors often collapse posteriorly until they reach the support of the mandibular anteriors.

In mesioclusion, or neutroclusion with the mandibular incisors occluding anteriorly to the maxillary incisors, due either to anterior displacement of the mandibular anteriors or to posterior displacement of the maxillary anteriors, special conditions are associated.

The maxillary and mandibular anterior teeth tend to erupt beyond the regular plane of occlusion, producing an excessive overbite. At the same time, because of the perversion of the force of mastication, the developmental stimulation is cut off from the middle third of the face, causing a marked underdevelopment of this region. Simultaneously, this stimulation is directed to the mandibular region, with the result that the malocclusion tends to progress to a more advanced stage.

At this point a distinction may be drawn between simple and complex malocclusions.

In a simple malocclusion, every deviation present is in its original state, being unmodified by the forces active in the teeth and their immediate environment.

In a complex malocclusion one or more of its deviations are directly caused by the prior occurrence of the other deviations, on account of the forces active in the teeth and their immediate environment.

Malocclusions presenting mesioclusion, distoclusion or lateral underdevelopment, in which no associated deviations are present in which a normal condition has not previously existed, are simple malocclusions. When a cause

of any deviation may be definitely attributed to the prior occurrence of another deviation, such as where the teeth have drifted, or excessive overbite occurs, or where a malocclusion has progressed from neutroclusion to mesioclusion or distoclusion, such malocclusions are complex malocclusions.

In this section attention is directed to the development of a method of examination to disclose all the morphologic deviations in a malocclusion, to distinguish the primary deviations from the secondary deviations ensuing as a result of physiologic influences, and to determine the essential causes of deviations within the limits of our present understanding. As compared with the generally employed diagnoses this data constitutes a physiologic diagnosis which may justly be deemed to provide a key to the regulation of complex malocclusions.

The first step in this methodical examination is to secure certain information both of a general and local nature.

Fig. 1 illustrates the form employed for obtaining this information in routine practice.

CASE NO. _____ DATE _____

Name — Referred by
Parent — Vocation
Residence — Remarks
Telephone

Age Birthday
When did first deciduous tooth erupt?
When did first permanent tooth erupt?
Infant feeding (breast or weaned)
Was a pacifier used?
Present state of general health
Any abnormality in facial development
Susceptibility to caries
Hearing
Relatives with malocclusions

Illnesses in childhood: Rickets, Scarlet fever, Diphtheria, Typhoid, Erysipelas, Measles, Chicken Pox

Lip development
Mouth-breathing
Thumb sucking
Lower lip interposed
Tongue biting
Enlarged frenum
Are nasal passages blocked?

Nasal passages: Tonsils, Adenoids, Septum, Rhinitis

Any operations for above?
Missing teeth and age when lost

If enamel is faulty, skin diseases in infancy

Special Notes

Fig. 1.

The next step in this examination is to disclose all the morphologic deviations present in a malocclusion, as they give an indication automatically of the corresponding etiologic factors that may exist. For this purpose plaster casts of the dental arches and x-rays are required. Two photographs, a full front view and a profile, may give useful information of the condition of the lips.

The details of a malocclusion are first noted in the following order:

1. The arch relations to determine Angle's classification.

2. The state of lateral development of the arches. The rational standard of normal lateral development for malocclusions is accepted as the minimum degree of lateral development permitting the harmonious alignment of the teeth in both arches.

3. Missing permanent teeth, either extracted or congenitally absent as verified by x-rays, supernumerary teeth, and all spaces in both arches.

4. All malpositions or displacements of individual teeth, including conditions of abnormal eruption, either overeruption or insufficient eruption, and rotation, tipping and drifting.

CASE NO. _____ DIAGNOSIS CARD DATE _____

1 _____	MAXILLARY _____ MANDIBULAR _____
2 _____	MAXILLARY _____ MANDIBULAR _____
3 _____	MAXILLARY _____ MANDIBULAR _____
4 _____	MAXILLARY _____ MANDIBULAR _____
5 _____	MAXILLARY _____ MANDIBULAR _____

LATERAL DEVELOPMENT

ESTIMATED _____ _____

ACTUAL _____ _____

SPECIAL NOTES _____

Fig. 2.—Blank diagnosis form for recording the deviations of a malocclusion in graded form. Primary deviations are recorded in the numbered columns on the left side, in order of diminishing significance. Secondary deviations associated with each primary deviation are listed on the right side in order of diminishing importance from left to right.

By this methodical examination of a complex malocclusion a series of morphologic deviations is distinguished. Before they can enter into the constitution of a diagnosis, the final step in this process, they must be correlated with reference to their etiologic significance.

In this diagnosis the most important deviation from the etiologic aspect whether functional or morphologic is noted first, and the particular morphologic deviations directly caused by it are then identified. If several important etiologic deviations are present, they are arranged in the order of their significance.

The form found most suitable for applying these principles is a blank diagnosis form, with one section for primary deviations and another for the secondary deviations, as illustrated in Fig. 2.

The primary deviations are arranged in order of diminishing importance and the secondary similarly from left to right.

The diagnosis of a malocclusion automatically outlines the program for its regulation. The merit of a diagnosis is apparent from the practical point of view in which not only all the defects that require attention are noted, but are also presented in graded order according to their relative significance.

CONCLUSIONS

Three considerations constitute the basis of this work.

1. The devising of a methodical examination to disclose every morphologic deviation requiring correction.

2. The adoption as a routine procedure of an effort to determine the fundamental causes of morphologic deviations so far as the understanding of the times permits.

3. The adoption of the rational diagnostic viewpoint of disclosing functional deviations in direct relation with their associated morphologic deviations wherever possible.

The etiology of many malocclusions is indefinite, and as with all endeavor in biologic fields a prognosis can never be made with certainty. On the other hand, a large number of deviations have been recognized which may reasonably be attributed to functional abnormalities. The employment of the methods expounded offers the expectation of correcting the maximum of those malocclusions in which success depends on the efforts of the operator.

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THE AMERICAN BOARD OF ORTHODONTIA

Origin, Aims and Procedures

SOURCE OF AUTHORITY

AT THE twenty-eighth annual meeting of the American Society of Orthodontists, held in Estes Park, July 16 to 19, 1929, The American Board of Orthodontia was created under a resolution offered by Dr. Martin Dewey, chairman of the committee which was appointed to consider the president's address, and was adopted unanimously. The resolution follows:

"Whereas, the President has recommended the formation of an American Board of Orthodontia similar to the American Board of Otolaryngology and other similar boards formed for the purpose of regulating the specialties of medicine, which boards have rendered valuable service in standardizing and increasing the efficiency of medical specialists; and

"Whereas, up to this time those engaged in the practice of orthodontia have had varying and sometimes insufficient qualifications for the practice of our specialty; and

"Whereas, the need of a high order of training is essential to orthodontic practice; and

"Whereas, there is a need of a body to designate standards of study and other qualifications for those who are to represent the specialty of Orthodontia; be it therefore

"*Resolved:* That the American Society of Orthodontists create and sponsor an organization to be known as the American Board of Orthodontia, which shall consist of seven men of unquestionable and outstanding reputation and accomplishment in the science of Orthodontia, who shall be nominated by the Executive Committee and elected by the general assembly at large; one to serve for a period of one year, one to serve for a period of two yars, one to serve for a period of three years, one to serve for a period of four years, one to serve for a period of five years, one to serve for a period of six years, and one to serve for a period of seven years; and one to be elected annually thereafter to serve for a period of seven years. The nominations made by the Executive Committee shall not be voted upon until the following day thereafter. Three fourths of the votes cast shall be necessary to elect a nominee a member of the American Board of Orthodontia. The Board shall organize and make rules regarding the requirements for examination of candidates for the granting of certificates of fitness, and to make such other rules and regulations as it may deem necessary for the proper functioning of the Board."

CHIEF ACTIVITIES

First. To establish standards of fitness for the practitioner of Orthodontia.

Second. To investigate the fitness of dental schools and private instructors to give proper training in Orthodontia, and to prepare lists of schools and instructors which shall be available to the profession.

Third. To arrange, control, and conduct examinations; to test the qualifications of those who desire to practice Orthodontia, and to confer a certificate upon those who meet the established standards.

These activities proceed from the object of the Corporation as stated in the Articles of Incorporation.

NO DEGREES CONFERRED

The conferring of a degree is left exclusively to the universities, and the Board shall make no attempt whatever to control the practice of Orthodontia by efforts to promote any license or legal regulation thereof. It shall aim to establish a standard of fitness to practice Orthodontia and to certificate those who apply and satisfy the Board of their qualification.

VALUE OF CERTIFICATE

The American Board of Orthodontia hopes that the work of this Board may become as great a factor in raising the standards of the teaching and of the practice of Orthodontia as has been the work of the American Board of Ophthalmology, and of the American Board of Otolaryngology. The work of these Boards has been so successful in raising the standards of teaching and practice in these specialties, that other important societies and organizations are following the example of these influential organizations. Moreover, the certificate of the American Board of Otolaryngology is required of candidates for appointments in many and various important positions in hospitals, colleges, etc., and for membership in all national otolaryngological societies.

It is anticipated that the dental profession and the lay public will learn to discriminate between those who are well fitted to practice orthodontia and those who are not, and will be influenced by the certificate of the American Board of Orthodontia in arriving at their conclusion.

VIEWPOINT OF THE AMERICAN BOARD OF ORTHODONTIA

The examinations of this Board are designed to test the candidate's fitness to practice Orthodontia. It will be the aim of the examiners to be broad-minded, avoiding on the one hand an unduly exacting standard above present available facilities for preparation to practice Orthodontia and, on the other hand, a laxity which would defeat the purpose of the examination. Thus, an older practitioner may not be minutely versed in certain of the details of anatomy, physiology, pathology, etc., which he may once have known; yet, his grasp of the science and art of Orthodontia and his fitness and competence to practice may be of high order.

On the other hand, to expect and to demand of the recent graduate the mature, well-balanced judgment and skill of the older practitioner, would be equally unfair. The examination, therefore, will be justly adapted to both classes.

Inasmuch as this Board is organized for the purpose of raising the standard of Orthodontia, it will be the policy of the Board to induce applicants who fail an examination to make an effort to overcome their deficiencies, and thus establish their fitness to receive a certificate from the Board.

APPLICANTS PASSED ON THEIR RECORDS

By agreement the Board has decided to certificate selected Orthodontists without a specific examination.

In some cases the applicant's professional record is such as to give him a national reputation. This fact, duly investigated and considered, may furnish ample evidence to satisfy the Board that the applicant is well fitted to practice Orthodontia. Such applicants for certificates will be "passed on their records." They will be expected, however, to conform to the requirements of filling out the necessary application blank and payment of the application fee.

All applicants must send recent photograph with application and must present themselves in person before the Board.

FEES

A fee of fifty dollars must accompany application blank. No application will receive consideration until the fee is received.

FEE NOT RETURNABLE

Application must be made on special blanks which may be procured from the secretary, and must be returned to the secretary, together with any other required credentials, at least sixty days prior to date of examination.

If the candidate fails in an examination, he will be admitted to a second examination after one year, however within three years, giving sixty days' notice of his intention to appear for re-examination; if a candidate who has failed does not appear for re-examination before the expiration of three years, he will be required to make a new application and pay the fee of fifty dollars before re-examination.

An applicant, having failed two examinations, must file a new application and pay an additional fee of fifty dollars.

Examinations will be held annually at, or near, the time and place of meeting of the American Society of Orthodontists.

An extra examination may be held, provided the number of applicants is large enough to warrant the expense incurred.

INFORMATION CONCERNING EXAMINATIONS

Applicants for examination and for the certificate of the Board are divided into three classes, according to the length of time they have practiced Orthodontia:

Class I. Those who have practiced Orthodontia exclusively fifteen years or more.

Class II. Those who have practiced Orthodontia exclusively seven years but less than fifteen years.

Class III. Those who have practiced Orthodontia exclusively less than seven years.

The following requirements are demanded by the Board for members of all three classes:

1. High ethical and dental standing in their communities, and also a dental degree satisfactory to the Board.

2. Formal application on an official blank with letters of endorsement by two well-known orthodontists.

3. Case histories may also be required; however, this requirement is left to the judgment of the Board.

The special requirements for each of the three classes are as follows:

Class I. The Board will determine from the applicant's training, published records, and professional work in his community, whether examination will be necessary before conferring its certificate. Case histories may also be required if, in the judgment of the Board, they are desirable.

Class II. Report of ten cases that have been treated by the applicant and observed through the postoperative period until a sufficient length of time has elapsed to determine the success of treatment. Also examination in certain subjects as the Board may require.

Class III. A degree from a dental school of high standing, satisfactory to the Board. Applicants, however, in this class will be required to take the examination as required by the Board.

CERTIFICATION

In determining the question of certification, the Board relies on the following criteria:

First. The applicant's professional record.

Second. Written reports on the prescribed number of cases that applicant has observed and treated.

Third. A practical, clinical, and laboratory examination, when required.

Fourth. Written examination, when required.

RECORD OF APPLICANT

The Board desires to know and to appraise the candidate's educational opportunities, dental and predental, as well as orthodontic; the character of the men under whom he has worked, private assistantships, laboratory work, clinics visited, research done, teaching, contributions to the literature of Orthodontia, membership in dental and orthodontia societies, and his general reputation.

CASE REPORTS

There shall be the prescribed number of case reports, such type of cases as the Board shall select. The case reports must cover all points of importance, be complete, concise, and properly expressed. Case reports must be typewritten and accompanied by the models of each case or photographs giving complete views of same, also photographs of patient's face and radio-

grams made before and after completion of treatment. These reports must be sent to the secretary at least sixty days before the examination.

Outline for the writing of histories of treated cases to be presented to the American Board of Orthodontia.

1. Title
2. History
3. Attributed Etiology
4. Diagnosis
5. Treatment Therapy Employed
6. Results Achieved
7. Prognosis
8. Observations and Conclusions

PRACTICAL EXAMINATION

The subdivisions of the practical examination are:

First. Examination of the oral cavity.

Second. Interpretation of radiograms.

Third. Examination of a number of patients, including models, radiograms and photographs, giving diagnosis and treatment. Further tests may be required in some cases if, at the discretion of the Board, this seems desirable to test the candidate's fitness.

WRITTEN EXAMINATION

The written examination is intended to cover such of the underlying principles of the science of Orthodontia as cannot be covered by the practical examinations. It will include anatomy, physiology, pathology, biology, and such other basic sciences as the Board may require, and their relations to the entire oral cavity and other organs of the body. After a few years, more stress may be laid on fundamental principles. However, it is one of the chief aims of the Board to improve the teaching of Orthodontia. No one can deny that, unless its foundations are laid broad and deep in the underlying sciences, the superstructure of clinical Orthodontia will be incomplete.

A WORD OF APPRECIATION

The American Board of Orthodontia gratefully acknowledges the valuable assistance rendered by the American Board of Otolaryngology.

Dr. Albert H. Ketcham, Chairman,
1232 Republic Building,
Denver, Colorado.

Dr. B. Frank Gray, Secretary,
209 Post Street,
San Francisco, Calif.

ERRATUM

DR. ABRAM HOFFMAN'S DISCUSSION OF DR. GUY S. MILLBERRY'S ARTICLE, "LEGAL PROTECTION OF EDUCATIONAL STANDARDS"*

Dr. Abram Hoffman, Chicago, Ill.—Mr. President, Dr. Millberry and Members: Your complimentary remarks have made the extemporaneous discussion of these excellent presentations more than ordinarily difficult, still, I thank you for your kind references.

Many of you know that I have been interested for a long time in this matter of orthodontic education, my frequent remarks deal with both the dental student and the family dentist. I wish to express my appreciation of the essayist's excellent presentation and of Dean Ward's discussion of the subject. A few notes made during the presentation for my personal use may now serve as a guide in this attempt at a few logical remarks.

I would have cherished the opportunity of studying this paper if for nothing more than my own enlightenment. For years I have been unable to convince myself that orthodontia was anything else than a very essential part of dentistry and that there could possibly be any just reason why certain phases of its practice should not be carried on in the same manner as any other branch.

It is a good characteristic for one to be able to change his mind—still, it is amusing to see the ease and complete change of mind that is sometimes possible when the desired goal seems to be in accord with one's personal desires—what I mean is just this: It is not so long ago that some orthodontists stood definitely for the principle that at least three and better five years of general practice were necessary as a foundation for the study and specialization in this service; again, the dentist has been allowed to believe and even given to understand that orthodontia was only for the specialist—one who was possessed of special knowledge and unusual technical skill. We note, by way of comparison, the elimination of any dental education (as such); the removal of any practical experience and the proposed acceptance of still more immature minds as specialists than has heretofore been deemed advisable; we find our literature and trade advertisements exploiting the ease with which malocclusion may be mastered by means of short periods of instruction and by the use of appliances, seemingly so simple that a child can operate them. To me it is all a paradoxical situation made up of directly opposing theories.

Occlusion of the teeth is the basis of all dentistry and the prevention or correction of malocclusion is perhaps the prime object of orthodontia; therefore, orthodontic principles, instead of being divorced from dentistry, should be injected to a greater and still greater degree into the dental curriculum, impressing the importance of "normal" occlusion upon all who would deal with oral tissues in health service. Instead of lessening the amount of orthodontia in the dental curriculum, the orthodontia should be increased, this, by cutting down in other branches which have been allowed to reach the point of overcrowding because of the greater enthusiasm of teachers.

The demand for orthodontia service is far in excess of the supply of skilled operators and the dental profession is in duty bound to meet this emergency.

It is sound pedagogy to say that a well-rounded dental curriculum affords the best foundation for the study of orthodontia. I am not as completely in accord with the idea that the young orthodontist should have from three to five years of dental practice before specialization as formerly. In fact, it seems to me that with the excellent teaching now being done by the better dental schools a young man may save several years of valuable time by taking his graduate course in orthodontia immediately after receiving his D.D.S. degree. This would not only conserve the young practitioner's time but it would stimulate more

*Because of an unavoidable delay, Dr. Hoffman's discussion was omitted from the discussions immediately following Dr. Millberry's article in the December issue. It will appear in its proper place in the Transactions of the Society.

young men going into this specialty, thus serving to increase the number of orthodontists and decrease the very apparent demand for the service.

At Northwestern University we have definitely taken the stand that orthodontia is to be a major course. We propose to accomplish this condition somewhat along the lines suggested by Dr. Millberry. The acceptance of this general plan by several of the leading dental schools has been a great satisfaction to me—to see orthodontia placed upon a par with other subjects in the curriculum has long been a hobby of mine and you may all imagine my satisfaction when the late Dean Holmes C. Jackson of New York University lent a receptive ear to my proposals, whereby that school became the first school to declare for this idea. I feel perfectly confident that orthodontia will soon occupy its rightful position in dental education by being cemented closer to dentistry rather than being divorced from it.

It is not a part of my scheme to try to make a specialist of the undergraduate student, but rather to prepare him so that he may leave school with a proper conception of this subject and to be qualified to practice preventive orthodontia, or, to use a better term, intercept malocclusion in its incipiency, and thus prevent the necessity for complicated orthodontic treatment later in life. Such training would not affect the practice of the specialist except to increase it. If the young practitioner can *intercept* malocclusion he will be rendering a greater service to the public than a combined number of orthodontists can render later in life.

The man who wishes to specialize should qualify by attending a graduate course in orthodontia and such courses should be given only under the auspices of university dental schools and, too, such a course should be at least one year in length. The short post-graduate courses have served an admirable purpose and in the main they have been given with much sincerity, but I believe their days are numbered. There are other fields than practice open to the men who avail themselves of a graduate course. The dental schools are urgently in need of more orthodontia teachers and again, there is urgent need for more research in orthodontia and it is from the graduate courses that such men should be recruited.

My interest in this branch of dental education is so profound and my ambition so sincere, that I become enthusiastic whenever the subject is mentioned, so for fear I may overrun the amount of time which our President has desired me to consume, I will close by expressing a thought upon the legal protection of educational standards; our laws will undoubtedly have to be amended in order to meet some of the changes that are to come because of specialization but such changes are not an impossibility; when laws such as the one to which we have been referring can be enacted, it certainly should not be a difficult matter to enact laws in accord with the requirements of better education and practice especially when the request is supported by a goodly representation from our ranks.

I wish to thank you, Mr. President, for the courtesy accorded me, and thank you all for your interest.

DEPARTMENT OF
ORAL SURGERY, ORAL PATHOLOGY AND SURGICAL ORTHODONTIA

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BILATERAL FRACTURE OF MAXILLA WITH FORWARD DISPLACEMENT*

By Robert H. Ivy, M.D., D.D.S., F.A.C.S., and Lawrence Curtis, A.B., M.D., D.D.S., Philadelphia, Pa.

FRACTURES of the maxilla are much less common than those of the mandible, although they are being seen with increasing frequency, because of automobile accidents. They are often associated with extensive head injuries, fracture of the base or vault of the skull and of other facial bones, such as the malar, nasal, and frontal, as well as the mandible.

Fractures of the maxilla may be classified as follows:

1. Fracture of the alveolar process alone.
2. Unilateral fracture through the median line of the palate and across the facial aspect above the roots of the teeth.
3. Bilateral horizontal fracture beneath the orbital plates.
4. Extensive comminution and crushing of the upper part of the bone, complicated by fracture of the nasal and other bones.

Fracture of the alveolar process alone may occur in the extraction of teeth. The tuberosity is occasionally fractured during extraction of the third molar. A blunt localized force, such as by a thick stick against the teeth, may result in this type of fracture. In addition to the break in the bone, tooth roots may be fractured, or teeth may be broken off. There will usually be more or less displacement of the fragment with malocclusion of the teeth, and gentle manipulation of the teeth will reveal mobility of the loosened fragment. The x-ray is useful in indicating the extent of the fracture and also the involvement of tooth roots.

Any hopelessly detached and fractured teeth and roots should be removed. If the fragment of alveolar process is covered by and attached to overlying gum

*From the Hospital of the Graduate School of Medicine, University of Pennsylvania.

tissue, it is usually possible to obtain union by a splint bridging the fragment and teeth in the sound portion of the jaw; or the maxillary and mandibular teeth can be fixed in occlusion by wires on teeth in a sound portion of the maxilla connected with some of the mandibular teeth. If the fragment is exposed by loss of overlying soft tissue it is generally necessary to remove it as necrosis will almost certainly occur.

Unilateral fracture of the maxilla is usually caused by a direct force coming from in front and to one side. In addition to the symptoms of contusion of the side of the face, the entire maxillary dental arch on the side affected will usually be depressed and may be forced inward, causing a thickening on the palate due to overlapping at the palatine suture. By gentle manipulation, mobility of the fragment can be readily detected.

Most cases can be successfully treated by pushing the fragment back into place until the teeth are in occlusion, and then wiring the teeth of the sound side of the maxilla to those of the mandible.

Bilateral horizontal fracture is usually caused by direct force from in front, such as by striking the steering wheel of a suddenly arrested automobile. In the majority of cases, the entire maxilla is displaced backward and downward. The fracture may extend back through the pterygoid processes. The entire dental arch can be moved as a unit. In bilateral fracture of the maxilla, fixation by means of the mandible is not advisable, because of the movability of the latter. Support here should be obtained from the bones of the skull by means of a head apparatus, as described by Marshall,[1] which is also depended upon in cases of displacement to furnish means of slow reduction by elastic traction. A vulcanite or metal splint is attached to the maxillary teeth. From the splint heavy metal bars emerge at the corners of the mouth passing back for a distance over the cheeks. A plaster of Paris skull cap is made, in which are embedded straps or hooks which can be connected with the bars emerging from the mouth to make traction in the desired direction. When reduction has been attained, the maxillary and mandibular teeth can be fastened in occlusion until consolidation is complete.

In cases complicated by extensive crushing and comminution of the bones of the upper part of the face, it will be realized that upward pressure against the skull cannot be employed since the normal vertical length of the face would not be preserved. Here a metal or vulcanite splint is made for the maxillary teeth as before, with bars extending from the mouth, but instead of making upward pressure with straps, the dental splint must be suspended rigidly at the proper distance from the skull cap by means of vertical solid metal bars or rods. The following case is reported because of the unusual displacement of the maxilla forward instead of backward.

W. R., male, 46 years old, was admitted to the hospital on Nov. 7, 1928, with the following history:

On October 28, 1928, while looking upward, he was struck on the right cheek by a falling steel window sash, the blow rendering him unconscious for one hour. There was a large contused lacerated wound of the right cheek, extending through into the maxillary sinus and tearing the mucous membrane of the mouth at the site of the first molar, which was missing. The entire maxilla on both sides in front of the second molar regions was freely movable as a unit, the fracture extending transversely from one side to the other

Fig. 1.—Radiograph showing fracture in front of second molar of maxilla, with forward displacement.

Fig. 2. Fig. 3.

Fig. 2.—Side view, with head cap and traction apparatus.
Fig. 3.—Impression tray applied to maxillary teeth.

below the nasal bones, and across the hard palate. The dental arch was displaced forward about the width of a molar tooth, so that the maxillary anterior teeth projected about 2 cm. in front of the mandibular teeth (Fig. 1). There was also considerable downward displacement. Immediately after the injury, the wound through the cheek had been explored, several loose bone fragments removed from around the opening into the maxillary sinus, and through and through drainage into the mouth instituted. The wound and the maxillary sinus were kept clean by frequent irrigation with boric acid solution.

Nov. 9, 1928, twelve days after the injury, reduction apparatus was applied as follows: A plaster of Paris head cap was first made, according to the method described by Scogin.[2] In the plaster on each side were incorporated hooks made of coat hanger

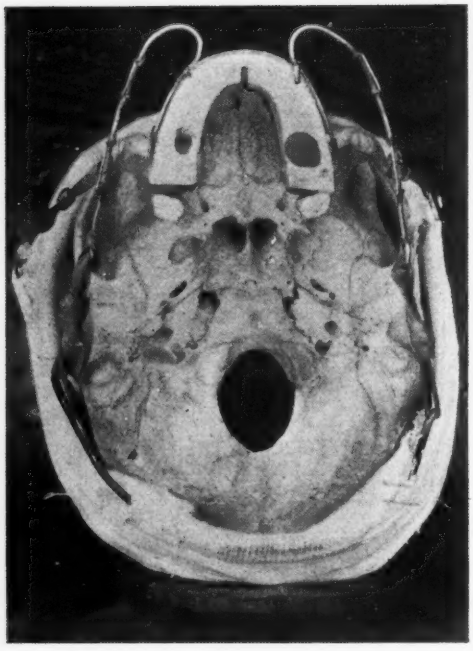

Fig. 4.—Front view of patient with apparatus in position. Wound of right cheek.

Fig. 5.—Radiograph after reduction of fracture. Compare space between molar and premolar with that in Fig. 1.

wire, one in front of and above the ear and another below and behind the ear, as shown in Fig. 2. A heavy wire was attached to the outer edge of a shallow aluminum impression tray on each side and shaped so that it would emerge from the corner of the mouth and curve backward over the cheek. The impression tray was fixed to the maxillary arch with a small amount of impression compound (Fig. 4). Backward and upward traction was then made on the maxilla by heavy rubber bands connecting the hooks on the headgear with the wires emerging from the mouth (Figs. 2 and 3). It will be noted that the reduction apparatus was applied two days after the patient was first seen. A much greater delay would have been necessary had a special apparatus been made for the case from impressions and casts of the teeth. The intraoral apparatus employed can be made in two or three sizes and kept on hand so as to be immediately applicable in any case when the need arises.

In ten days, by the method described, the fractured maxilla was drawn back into normal position so that on Nov. 19 the apparatus was removed and the teeth found to be in good occlusion (Fig. 5). The maxillary and mandibular teeth were then wired in occlusion for a further period of two weeks (Fig. 6). Examination at that time showed

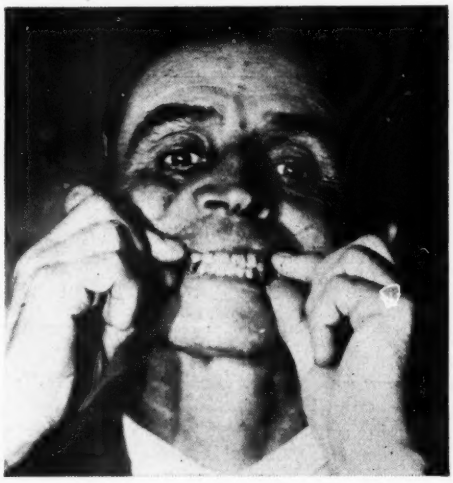

Fig. 6.—Occlusion of teeth after reduction.

firm union of the maxilla with good occlusion of the teeth. The external wound had entirely healed, leaving a vertical depressed scar on the right cheek. May 31, 1929, the patient returned for observation and the occlusion of the teeth and function of the jaws were found to be normal. A simple operation under local anesthesia corrected the depression in the cheek.

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2. Scogin, C. W.: Internat. J. Ortho., Oral Surg. and Rad. **14**: 526, 1928.

THE CONSIDERATION OF CONTOUR AS WELL AS FUNCTION IN OPERATIONS FOR ORGANIC ANKYLOSIS OF THE MANDIBLE*†

By Vilray P. Blair, M.D., F.A.C.S., St. Louis, Missouri

PREVIOUS to 1872, the common plan of treating ankylosis of the jaw was by forceful stretching or by excision of a section of bone from the angle or body. In 1858, an Englishman named George Murry Humphrey excised an enlarged condyle of the mandible. However, the operation of excising one or both condyles for an ankylosis is usually credited to Bottini, who published his report[1] in 1872 (Fig. 1). Before 1900, almost every conceivable type of operation for this condition had been reported, even to removal of the jaw.

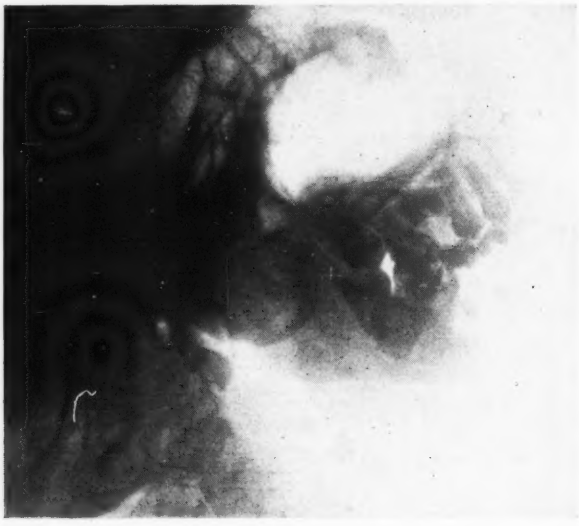

Fig. 1.

This subject is again brought to your attention, not in the belief that anything really new will be presented, but rather to emphasize certain factors, the detailed descriptions of which are rather meager or lacking in the literature, and also to bring out a few special points, which will be emphasized by citing appropriate cases.

MECHANICS

Excluding inflammations, tumors, fractures, and muscle spasm, chronic limitations of the movement of the mandible may be due to: (a) fibrous or bony changes of the joint itself (Figs. 1 and 2); (b) change in the shape or bony fixation of the ramus (Figs. 9-*D* and *E*); (c) scars about the joint or in the cheek (Figs. 6-*A* and *B*, Fig. 9); (d) infringement of a neighboring bony process (Fig. 5); (e) a combination of any of the above factors (Fig. 9).

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†From the Department of Surgery, Washington University School of Medicine.
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OPEN OPERATION VERSUS FORCEFUL MANIPULATION

Though occasional successful instances have been reported, forceful dilation of a limited jaw opening of long standing, which has developed gradually, is seldom satisfactory and is not worth the effort involved (Fig. 1). For permanent relief the cause of the fixation must be eliminated or modified; the more accurate the preoperative determination of this cause, the better and simpler will be the correction. Halfway measures may give relief much more lasting than simple stretching, but both are apt to be disappointing. Exposed

Fig. 2-*A*.

Fig. 2-*B*.

Fig. 2-*C*.

Fig. 2-*D*.

scar bands should, where possible, be dissected out and replaced by a skin-bearing flap rather than simple incision with inlay Thiersch graft. In attempting correction by operation, it is, in most cases, better practice to remove the upper part or almost all of the ramus rather than to try to reconstruct the joint. The latter is a nice operation, but the former is much more apt to be successful.

EXTERNAL DEFORMITY

When the ankylosis has existed during the growing period and is due to a fixation within the joint itself, whether bony or fibrous, there will be some shortening of both the ramus and body on the affected side with a corresponding backward and lateral displacement of the chin (Figs. 2, 3, 18). If the fixa-

tion is unilateral and not complete, the chin will further deviate to the affected side when an attempt is made to open the mouth. This latter point may be helpful in determining which joint is fixed.

INCREASED ANTEROPOSTERIOR BREADTH OF THE RAMUS

If the limitation of movement is primarily due to scar bands that fix the mandible to the maxilla, the ramus may become abnormally broad from before backward. This might possibly be due to a failure of the anterior border of the ramus to be absorbed as is ordinarily concurrent with the normal growth of the mandible. In addition to this abnormal breadth the two jaws may be found fixed to each other by bony union (Figs. 9-*D* and *E*) If the injury to the soft tissues happens after growth is completed, the subsequent scarring does not seem to cause these bone distortions (Fig. 11-*A*). Elimination of the scars with restoration of the soft tissues soon after injury may prevent this distorting growth of the bones (Fig. 12-*A*).

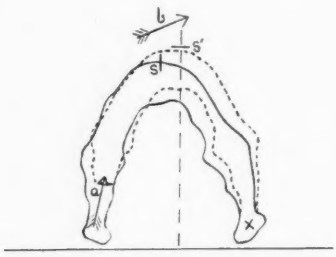

Fig. 3.—*S*. symphysis; *S'* is point to which symphysis would move if it rotated to the midline with *X* as a center; arrows *a* and *b* show directions of movement.

RELATION OF CONDYLE TO NORMAL MOVEMENT

While the presence of a normal condyle is essential to the normal development of the mandible and of the temporomandibular joint, and to normal strength and stability and mobility of the mandible, still neither condyle is essential to useful function (Figs. 13-*A* and *B*). My own conclusion is that the mandible is hung in such a perfect muscular balance that both condyles can be removed and, where desired, the jaw can be moved forward without seriously crippling function (Figs. 14 and 15). This latter point probably explains the universal success in the restoration of this joint obtained by the simple excision of sufficient bone with or without complicated efforts to furnish a substitute for the necessary joint surface. I have always attempted to interpose a fatty flap or superficial temporal fascia, not with the idea of placing a barrier between the bony surfaces, but to help fill the dead space that is left after removing the condyle (Fig. 7).

CORRECTION OF THE EXTERNAL DEFORMITY

That a plea should be made for the improvement of contour as well as for the restoration of movement is the chief aim of this paper (Figs. 6 to 15). Correction or improvement in appearance may be accomplished by one, or a combination, of several of the following procedures:

1. After the fixed joint is freed, the affected side of the mandible may be dragged forward and fixed in this position until the tendency to recede is overcome (Figs. 3, 7, 16, 17, 18). At first the fixation is made by interdental wiring, but later the pull of a rubber band may be used. In unilateral ankylosis, with a receding mandible, it may be necessary to section ramus of opposite side to get best attainable position of body of jaw (Fig. 4).

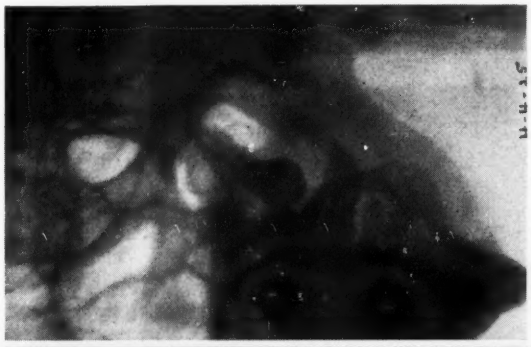

Fig. 4-*C*.

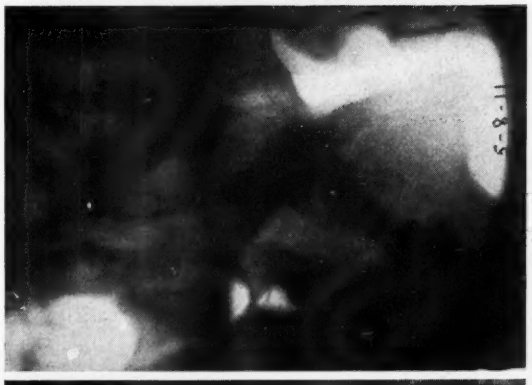

Fig. 4-*B*.

Fig. 4-*A*.

2. The receding chin can be built out by means of an implantation of costal cartilage (Figs. 7, 15, 17, 18).

3. The facial obliquity remaining after fixing the jaw bone in its new position can be rendered less noticeable by shifting the soft tissues of the chin laterally, by filling along the flat side of the jaw with cartilage or by a combination of these (Figs. 17-*A*, *D*, and *E*).

TYPES OF CASES AND METHODS OF TREATMENT

Bony Overgrowths About the Joint.—Double Resection and Partial Open-Bite.—A blow on the face may be followed by an overgrowth of one or both condyles or of the neck, and there may be an associated downward growth from the temporal bone. Any of these may distort the joint and limit movement without causing a true ankylosis. It was probably such a case that was originally operated upon by Humphrey. Fig. 1, a roentgenogram taken in May, 1925, shows such an overgrowth. In 1912, at the age of ten years, the patient was referred to us by Dr. C. H. Clay, with a history of previous good health, but at the age of eight years she had fallen half a story onto her face. Three months before we saw her,

Fig. 5.

Fig. 6-*A*.

Fig. 6-*B*.

she could not open her mouth freely, and at this time the symphysis was slightly to the right, the right mandibular canine being slightly behind the maxillary canine. The opening between maxillary and mandibular lateral incisors was 13 mm., the limit of movement was not sharply defined but could be forcefully stretched. In March, 1913, the opening was stretched to 3 cm. and it was 22 mm. three days after this operation. The child was kept under observation for two months with no decrease in the opening. She returned in March, 1925, with only a suggestion of movement. Both joints were then excised, including the condyles and the overhanging bone that arose from around the outer wall of the glenoid fossa. The mandible was dragged forward and fixed for twelve days, at which time the interdental wiring was removed. It was found that while movement was not paradoxical (Fig. 13), because of the elevation of the occlusal surface of the molars there was a separation of the incisor teeth which would require further treatment.

This is the second case of ours in which, after the resection of both joints at once, there was a partial open-bite in the incisor region and both followed early removal of the dental fixation. If the immediate restretching of the opening and the rewiring of the teeth will not remedy this, it can be corrected by sectioning the ramus on each side below the site of the previous operation and then fixing the jaw in occlusion until bony union occurs.

Shortening of the Ramus and Retraction.—Figs. 2-*A* and *B*. We have x-ray pictures of a child three years old who had gonorrheal arthritis at birth resulting in an ankylosis on the left side. Fig. 2-*A* shows the left ramus and damaged joint. Notice that the developing

Fig. 7-*A*.

Fig. 7-*B*.

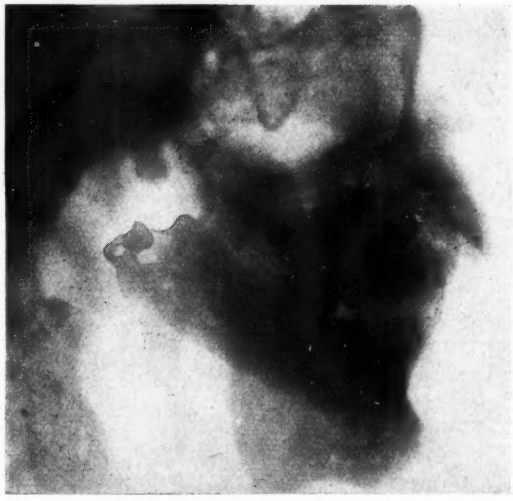

Fig. 7-*C*.

sixth year molar, *a'*, is in the ramus and completely distal to the sixth year molar in the maxilla, *b'*. On this side the ramus in the roentgenogram measured only 5 cm. in its greatest length while in Fig. 2-*B*, the uninjured side, the relationship between the maxillary and mandibular sixth year molars is about natural, and the ramus measures 6 cm.

Direction of Rotation in Bringing the Jaw Forward.—Fig. 3 is a diagrammatic representation of a mandible, short from before backward on the left side on account of an ankylosis of the left joint, which occurred during the growing period. After fixation was relieved, we were able to bring the symphysis forward and to the right by rotating the bone around the center which is at the right condyle. The left ramus will move in the direction

of the arrow, *a*, the symphysis in the direction of the arrow, *b*. Note that the symphysis moves forward as well as toward the midline.

Section of the Ramus to Bring Forward the Body.—The patient shown in Figs. 4-*A*, *B*, and *C* had scarlet fever and suppuration around the left temporal mandibular joint at two years. At sixteen years she had extreme recession of the chin and inability to open the mouth. From lack of appreciation of the true mechanics of the condition, in February, 1908, I cut both rami in two and dragged the body forward. This brought the chin into a better position but did not permanently cure the ankylosis. The result of this is shown in Fig. 4-*A*, which was taken late in 1908. *X* marks the posterior border of the upper part of the ramus dragged obliquely forward as the body was advanced. *Y* shows the ramus below the bone cut. The bone cut itself is indicated by the light line between these two. The resulting false joint later became fixed, and the left condyle was therefor removed.

The proper procedure in this case would have been at the original operation to have removed the left condyle and cut through the right ramus. This would have restored movement and at the same time permitted bringing forward the jaw.

Fig. 4-*B* was taken in 1911 and Fig. 4-*C* in 1925. A study of the relations of the two last molar teeth will show there was a slight recession of this side of the jaw after removing the condyle. The wire and nail shown at the symphysis in Fig. 4-*A* are in a cartilage

Fig. 8-*A*.

Fig. 8-*B*.

implant made in September, 1908, and in spite of some immediate suppuration, the cartilage has remained in place ever since. This type of cartilage fixation is not used any longer.

Limitation of Movement, Due Partially to an Overdeveloped Styloid Process That Prevented Normal Backward Excursion of the Angle.—Fig. 5 is a roentgenogram of a five-year-old patient who was crushed under a falling bale of hay and generally injured. Between the ages of eleven and twelve years, it was noticed that she could not open her mouth freely. Examination showed that the excursion of the mandible was limited, and from that time on, the chin became relatively more receding and downward excursion of the mandible lessened. When she consulted us, the patient was twenty-one years old, delicate and very thin. The mandible was undeveloped and the greatest possible vertical opening between the maxillary and mandibular incisor teeth was one-eighth of an inch. Because of the backward displacement of the jaw, the mandibular incisors were one-fourth inch behind the maxillary, which, with the one-eighth inch opening, gave a possible feeding space. We thought that the lack of development was related to the early injury, but this did not explain the limited movement which presented the following peculiarities: The movement was free until the opening between the incisor teeth was one-eighth of an inch and then stopped suddenly. During this movement the right condyle traveled forward as much as it would do in normal full opening of the mouth. The left remained apparently stationary, and the chin moved to the left more than it did downward. This whole picture could be explained on the theory that there was a loose, fibrous ankylosis of the left joint, and on that side the angle was prevented from moving backward by striking some firm object. A poor x-ray picture, the best available at this time, failed to throw light on this point.

The indications in this case were to give a free opening of the mouth, to establish a better occlusion of the teeth and to improve the profile by carrying the chin forward and holding it there. The rami were sawed transversely on both sides, and the body of the jaw was brought forward until the mandibular incisors were a little in front of the maxillary incisors and the chin was symmetrically placed. It was wired in this position. In four weeks the union was examined and found not to be strong, so the teeth were rewired for eight weeks more. When the wires were removed from the teeth, it was found that the mouth opened freely one-half inch and that the limit of movement was some yielding structure. Examination, one year later, showed that the lateral movements were normal and the possible opening between the incisors was seven-eighths of an inch, which is sufficient for good function.

A good roentgenogram taken some years after the operation showed that the styloid process on the left side was almost the size of her little finger and at full opening abutted against the inner side of the angle of the jaw. It also showed a change about the left joint that suggested at least a fibrous ankylosis. This corresponded with the original deductions. When the body was moved forward, a space was obtained between the angle and the styloid process which gave room for the angle to travel backward and approximate normal movement.

Another patient had an arthritic fixation of the cervical spine with the head bent slightly forward, but even after the resecting of both condyles, the excursion of the mandible was still quite limited by the chin striking against the thyroid cartilage.

Scars About the Joint Preventing Forward Replacement.—Unless the jaw is dragged forward and an interlocking occlusion established, the removal of the condyles will not correct the backward position of the body of the jaw (Figs. 6-*A* and *B*.)

Fig. 6-*A* shows a child, five years of age, with a close fibrous ankylosis of both joints, with a good deal of periarticular scarring, all due to an early infection of some kind. At operation both condyles were resected, but on account of the scarring in the soft parts it was impossible to move the body of the jaw forward.

Fig. 6-*B* shows the same child one year later, at which time she had a functional opening of the mouth.

Asymmetry Associated With an Early Unilateral Ankylosis.—At the age of six years this patient (Figs. 7-*A*, *B*, and *C*) had a tooth infection and necrosis of the jaw on the right side. At twenty-four years, when he came for treatment, the most noticeable points were lateral prominence of the body of the jaw toward the ankylosed side, with corresponding flattening on the opposite side, deviation of the chin, lips, and nose toward the affected side with obliquity of the mouth slit as compared with a line drawn through the palpebral fissures. The partial correction here shown was made by removing most of the right ramus and rotating the jaw bone to the left, shifting the soft tissues of the chin still farther to the left and implanting a cartilage. In this, the first case in which we attempted to move the soft tissues on the bone, the chin was brought to correspond almost with the axis of the nose, as shown in Fig. 7-*B*. A more acceptable result would possibly have been obtained if the chin had been brought nearer to a vertical line dropped from the midpoint between the brows at right angles to the axis of the palpebral fissures as was done in Fig. 17-*E*.

Fig. 7-*C* shows the large amount of the ramus that was removed to permit bringing forward the right side of the mandible. In the case shown in Fig. 17, it was necessary to remove a still larger part of the ramus, including that part which held the roots of the third molar, before the mandible would clear the maxillary molar teeth. This large removal of the ramus seems to cause no functional inconvenience in a single resection but I believe it not permissible in a double ankylosis. In the latter case, I believe it is desirable to retain the coronoid process and temporal muscles.

Lateral Deviation.—A child eleven years old (Figs. 8-*A* and *B*) at four and one-half years had meningitis, following which partial ankylosis gradually developed. Fig. 8-*A* shows the full extent of the opening when he came for operation; Fig. 8-*B*, the possible opening sixteen days after removal of the condyle and upper half of the left ramus, but this opening should increase considerably in the next three months. The point brought out in this il-

lustration is that the tendency, when the mouth is opened, for the chin to deviate to the resected side, still persists.

Scar Fixation—Late Results.—A woman thirty-eight years of age (Figs. 9-*A*, *B*, and *C*) was referred to us by Dr. W. C. Drummond. At eleven years she had probably a noma and lost part of the cheek, left upper lip, lining of the cheek and part of the left maxilla bone; when it healed she could not open her mouth. Fig. 9-*A* shows the condition in Feb-

Fig. 9-*C*.

Fig. 9-*B*.

Fig. 9-*A*.

ruary, 1918, with mouth open to the fullest extent, 4 mm. between maxillary and mandibular incisors. Fig. 9-*B* shows the extent of the opening after the removing of the upper end of the left ramus, the removing of the cheek scars and the replacing of lining and external cheek tissues with flap from forehead. The mouth opened 2 cm. between incisors December 12, 1924, but this has increased since. Figs. 9-*B* and *C* were taken February 13, 1925. Fig. 9-*D* shows a normal joint but a somewhat wide ramus and coronoid after twenty-seven years of almost complete fixation. Fig. 9-*C* shows the left, the injured side, with only relative growth

changes about the joint itself, but with tremendous widening of the ramus and posterior part of the body. Originally the bony mass at the outer border of ramus or of the posterior part of the body had acquired bony union with the maxilla, but this was chiseled through at the original operation in 1918 by Dr. A. O. Fisher and had not reunited. The joint changes shown on this side, in Fig. 9-*C*, were a relatively small condyle and a very deep narrow glenoid fossa with a correspondingly high articular eminence. In the note on the 1918 operation, it

Fig. 9-*E*.

Fig. 9-*D*.

is stated that after cutting the scars and cutting the bony union between the two jaws, the mouth could be forcefully opened 3 cm. and was blocked in this position, but in 1924 after cutting all the reunited scar bands we were not able to open the mouth until the joint and upper half of the ramus were removed.

Scar Fixation—Late Results.—In Fig. 10 we have the photograph of a woman referred by Dr. H. R. Shands, who, in 1923, was twenty-two years of age. At thirteen years, following typhoid fever, she had a noma which destroyed the lining and considerable of the surface

of the left cheek. Following this, she could not open her mouth. Some time later the lining scar had been removed and the cheek lined with a flap turned from the neck, but she stated it did not relieve the fixation. When first seen by us, March 12, 1923, she had an opening between the incisors of 6 mm. Fixation apparently was due to a scar band in front of the cheek lining that had been obtained from the neck at the previous operation. However, a functional opening was not obtained until the abnormally wide ramus was removed and the cheek lining pieced out and the buccal and labial sulci were restored by means of thick Thiersch grafts inserted on 3 wax forms. *X* shows the area lined by the original neck flap. The shaded area shows the amount of lining that was obtained from the Thiersch grafts, but there is always considerable contraction of these thin free grafts, for which provision has been made. The dotted line shows the profile of jaw bone bringing out the increased antero-posterior width of the ramus.[2]

The lower lip was subsequently raised by a flap thrown under the chin. Still further correction was done later by Dr. J. E. Johnson, of Memphis.

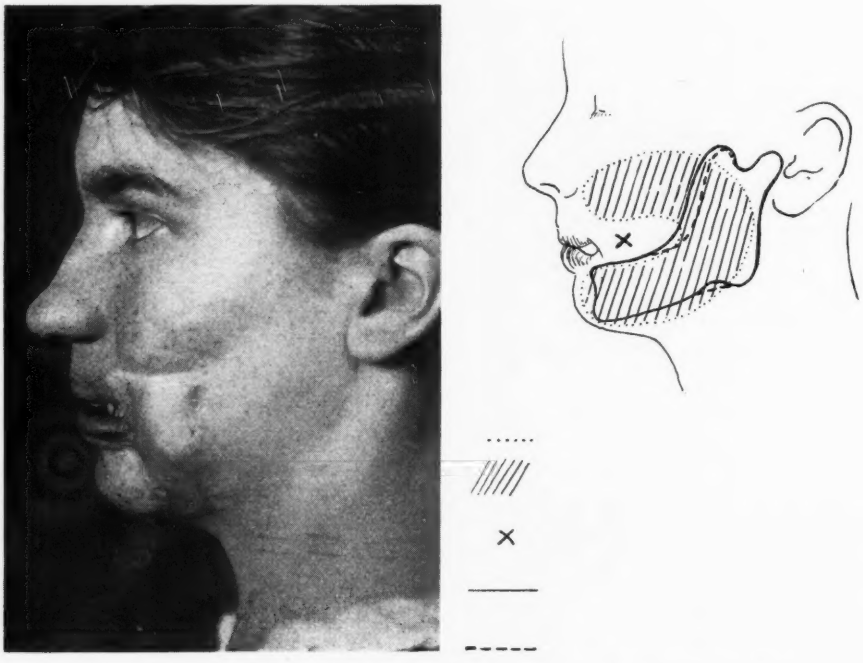

Fig. 10.—. . . . . Indicates limits of Thiersch grafts; ////, area grafted; *x*, original flap that was placed in mouth ten years previously; ——, outline of mandible showing increased breadth of ramus and notch below ramus; - - - - -, approximate outline of average normal mandible.

Scar Fixation—Later Results.—Fig. 11-*A* shows a woman thirty-six years old, referred by Dr. Royal Wight. Seven years previously, following the extraction of an infected tooth in the acute stage of the inflammation, she had a necrosis of the bones and considerable loss of the soft tissues. The edentulous gums are held almost in contact by the cheek scar. Compare with Fig. 11-*B* and notice in Fig. 11-*A* that the distance from nose to chin is much shorter and besides the hole in the cheek and its scarring, the corner of the mouth is drawn up and back. In this case, as the injury occurred after the bones had ceased to grow, there was no great deformity of the ramus and joint, and the correction consisted only in the release of the scars and the replacement of the destroyed soft tissues. This was done by first throwing a double pedicle flap from the neck to line and cover the cheek and then later by restoring the upper and lower sulci by Thiersch grafts put in on wax forms. The oblong area *X* in Fig. 11-*B* indicates the position of the lining flap derived from the neck, the dotted lines outline the wax forms and the striped surface, the extent of the areas covered with the inlay Thiersch grafts. These two procedures enabled her to open her mouth suf-

ficiently for function and also to wear complete upper and lower dentures. Notice the difference in outline of lips and chin as shown in Fig. 11-*A*.

Dense Cheek Scars Causing Ankylosis.—Figs. 12-*A* and *B* show a child of eight years in whom, after a gangrenous stomatitis at five years and several ineffective operations, the maxilla and mandible remained bound together by scars throughout the substance of the cheek that extended from the anterior border of the ramus to the canine region. In this

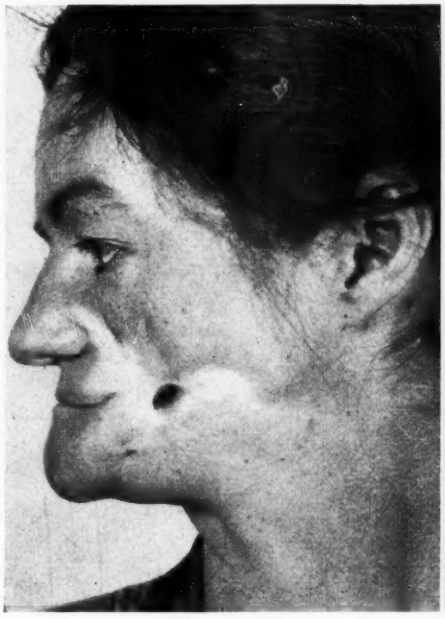

Fig. 11-*A*.

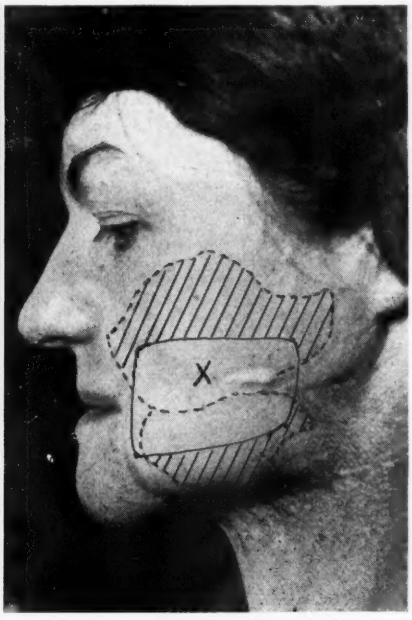

Fig. 11-*B*.

Fig. 12-*A*.

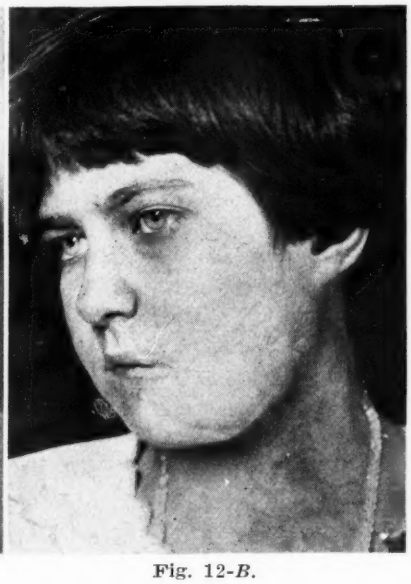

Fig. 12-*B*.

patient the restoration of the cheek was made before serious changes in the shape of the bone had occurred, and therefore no bone operation was necessary to restore movement.

Paradoxical Movement.—In Fig. 13-*A* we show a diagrammatic representation of the normal jaws, *X* indicating the axis of motion in the simple opening and closing; *G* glenoid fossa, and *A.E.* the articular eminence which together indirectly form a bearing or guide for the condyle during this movement; *T*, approximately the direction of pull of the temporal

muscle in closing the jaw; *I.T.M.*, approximately the direction of pull of the internal pterygoid and masseter muscles in closing jaw; *E.T.*, approximately the direction of pull of the external pterygoid in opening the jaw; *M.H.D.* and *H.G.*, approximately the direction of pull of the mylohyoid, digastric and geniohyoid muscles in opening jaw. If *G.A.E.* is a bearing, then the △ on the condyle would represent the fulcrum, the arrow *M.I.T.* approximately the power, and the teeth the load, of a lever of the third class. This is approximately true in ordinary movements of the normal jaw. If a bearing for the condyle at *G.A.E.* were essential to this motion, then on removal of the condyle, the molar teeth being present, the mandible would be converted into a lever of the first class with the load anterior to the fulcrum (△) and the power *M.I.T.* behind the fulcrum; contraction of the muscles of mastication would then draw downward that part of the jaw which is in front of this new fulcrum. In this condition *X*, the axis of movement and △ the fulcrum correspond. On these theoretical grounds we long hesitated to remove both condyles in a double ankylosis until the analysis of reported cases showed that it was not always followed by open-bite. It is something of this fear that probably causes men to limit the operation to those cases in which the joint can be reconstructed—an operation less apt to be successful than is a free removal of bone, and also it is an operation with a very much more limited field of accomplishment. Our own subsequent experience has shown that these theoretical fears are not entirely groundless. If both condyles are removed at one operation and the maxillary and mandibular teeth are not fixed together, contraction of the masticatory muscles will cause an opening between the incisor teeth and permanent open-bite may result. We have had this happen in 2 cases when the

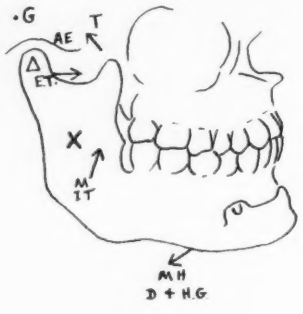

Fig. 13-*A*.

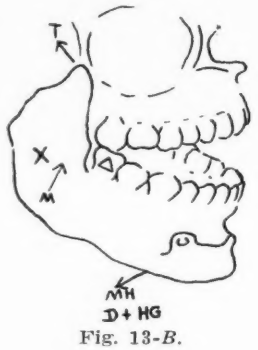

Fig. 13-*B*.

dental fixation was removed at the end of three weeks. In one child, however, in which the condyles were removed at eighteen months (Fig. 14) due to lack of teeth, no fixation of any kind was used and no paradoxical movement resulted. In other cases in which dental fixation was retained sufficiently long, eight to twelve weeks, a muscular balance was established that can closely simulate normal movement, even when there is no bony contact between the mandible and skull behind the occluding teeth, the axis of motion remaining approximately normal.

Muscular Balance.—In Figs. 14-*A* and *B* we have x-ray pictures of the ramus and joint regions of a child who five years previously, at eighteen months of age, lost both condyles from infection following bilateral fracture at the junction of the necks with the rami.

Fig. 14-*C* is an outline drawing of an average eighteen months' mandible showing the lack of development of the ramus at this age and also the approximate line of the fracture in this case.

In Figs. 14-*A* and *B*, roentgenograms taken five years later, it will be seen that, following the loss of the condyles there has been little or no subsequent development of the rami, and though the coronoid processes have become abnormally long, so that the tips approximate the normal point of insertion of the temporal muscles, these long coronoid processes have failed to migrate backward to a normal extent as proved by the shortness of the body and also by the fact that the twelfth year molar is seen developing in the base of each.[3]

In this child the body of the mandible is in a somewhat posterior position, but she can open and close, move jaw to either side and chew her food satisfactorily, but as demonstrated by the x-ray picture she has no bony contact between the mandible and the base of the skull.

The chief disability resulting from this condition is that neither this patient, nor one other similar one, can sleep lying on the back, for then, the muscles being relaxed, the jaw with the tongue drops backward and shuts off the pharyngeal airway.

Second Case Illustrating a Functional End-Result Without Bony Contact.—Traced profiles of a girl who at seven years had an auto injury leaving a scar on the chin, and was never afterward able to open her mouth, are shown in Figs. 15-*A*, *B*, and *C*. When referred for treatment in August, 1915, by Dr. A. H. Hammel, she, then thirteen years of age, had a complete bilateral bony ankylosis with typical retracted mandible as shown in Fig. 15-*A*. Both condyles were removed, and the dead space was filled with flaps of fat and fascia from the temporal regions. At the same time, the body of the jaw was drawn forward until the mandibular incisors were 4 mm. in front of the maxillary incisors and the jaws thus fixed by interdental wires. This gave the immediate profile (Fig. 15-*B*). The interdental wiring was retained for twelve weeks and when the fixation was removed she had all natural jaw movements, but these movements were not all normal. At a later period, Dr. L. R. Main extracted the first mandibular premolar on each side and drew back the canines and incisors

Fig. 14-*A*.

Fig. 14-*B*.

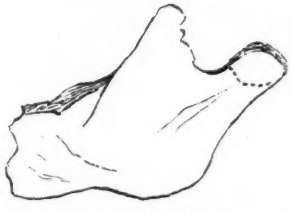

Fig. 14-*C*.

Fig. 14-*A*.—*C*, coronoid process; *E*, articular eminence; *G*, rudimentary glenoid fossa; *M*, posterior end of body of mandible.

into normal occlusion with their opponents. This gave her a rather acceptable facial outline, but with later growth the mandible failed to retain its harmonious relation with the maxilla and at eighteen years she again had a relatively receding chin as seen in Fig. 15-*C*. Five years after the first operation she had an opening of 26 mm.

Figs. 15-*D* and *E* show the same girl at the age of eighteen years, before and after inserting a piece of costal cartilage in front of the mental eminence.

Figs. 15-*F* and *G* are from stereoscopic x-ray films, *F* the right joint region and *G* the left. *M* is the mastoid process; *G*, the glenoid fossa; *A.E.*, the articular eminence; *N*, the rudimentary neck of the amputated condyle; *S*, the sigmoid notch; *C*, the abnormally large coronoid process. Comparing this area with corresponding area in Figs. 14-*A* and *B*, it will be observed that a subnormally developed ramus is present in the child who was injured at seven years while it is entirely absent in the child who lost her condyles at eighteen months. Further, that while in the younger child, at the age of six years, the twelfth year molar is developing in the base of the coronoid, in the girl of eighteen years, who was injured at seven and lost her condyles at thirteen, the third molar has erupted in front of the ramus (and base of the coronoid).

In the stereoscope it is very easy to verify all of these points. By noting the relation of the ramus and the condylar neck, *N*, to the glenoid, *G*, and the eminence *A.E.*, it will be

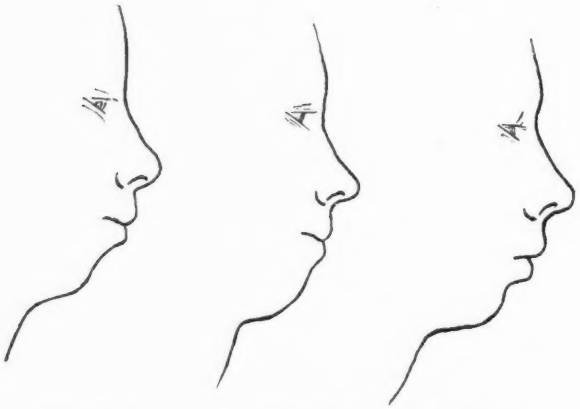

Fig. 15-*A*. Fig. 15-*B*. Fig. 15-*C*.

Fig. 15-*D*. Fig. 15-*E*.

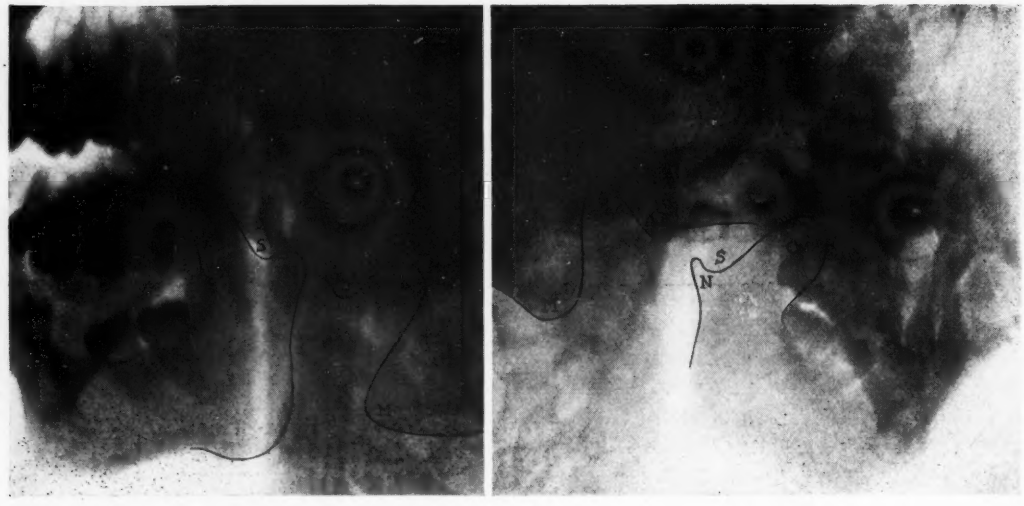

Fig. 15-*F*. Fig. 15-*G*.

Fig. 15-*F*.—*M*, mastoid process; *G*, glenoid fossa; *A.E.*, articular eminence; *N*, rudimentary neck; *S*, sigmoid; *C*, coronoid process

seen that the jaw has no bony bearing on the base of the skull, and that it has remained in the forward position, given to it at the ankylosis operation five years previously. The movements are similar to those described under Figs. 14-*A* and *B*.*

Preangular Notch.—Retraction of the chin is rather a constant accompaniment of an ankylosis developed during the growing period and is often much more pronounced when the face is viewed in profile than would be indicated from the occlusion of the teeth (Figs. 16-*A*, *B*, *C*, and *D*). On the other hand, facial symmetry is extremely variable.

Fig. 16-*A*.

Fig. 16-*B*.

Fig. 16-*C*.

Fig. 16-*D*.

This fifteen-year-old girl had a fall at five years, and six months later it was noticed that the mouth did not open freely. After the left joint was resected, the jaw was swung to the right until the symphysis was brought to the midline. This helped the profile very little, and sixteen days later a cartilage implant was made into the chin. In making these implants, we usually use a piece of the left eighth costal cartilage, preserving as much of the perichondrium as possible. Figs. 16-*A* and *B* show the profiles before the first operation and

*These observations upon the movements of the mandible minus condyles have been the subject of close study by us for a number of years, and the ideas here presented were formulated quite some time ago and later seemed to be confirmed by the movements and X-ray examination of case shown in Fig. 15, but their publication was withheld until another confirmatory case with as complete data could be studied. The full record of Fig. 14 has only lately been completed.

after the cartilage implant. Fig. 16-*C* shows the normal joint ramus and angle. There is a characteristic notch at the lower border of the jaw just in front of the angle on the ankylosed side, whether it be single or double (Fig. 16-*D*). In almost all cases of partial, single ankylosis, the chin deviates toward the ankylosed joint, as the limit of excursion is approached. In this case, for some unrecognized reason, the latter sign was absent and there was no thickening to be felt about the affected joint, but in spite of all this and without an x-ray examination, one could have recognized, in this case, which was the affected joint by the

Fig. 17-*A*.

Fig. 17-*B*.

Fig. 17-*C*.

Fig. 17-*D*.

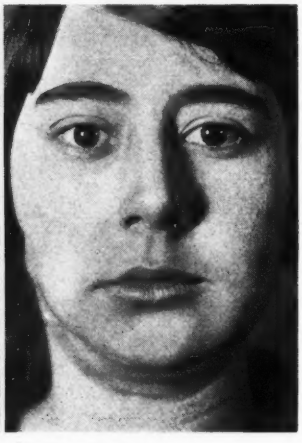

Fig. 17-*E*.

presence of the notch on that side. This roentgenogram shows the broad contact of the fibrous ankylosis, the shorter ramus, and the characteristic notch in front of the angle.

Correction of External Deformity.—For putting all one has into a case, one may be amply repaid (Figs. 17-*A*, *B*, *C*, and *D*). This young lady referred by Dr. A. B. Kanavel, came at the age of eighteen with the history of scarlet fever and discharging ears at the age of four months and a left mastoid operation at two years. Six months later the mouth opening was limited and the chin already deviated to the left. She had had orthodontic work for ten years and had one fat transplant into chin, as evidenced by the scar in Fig. 17-*A*.

Figs. 17-*A* and *D* show the characteristic deformities. In order to get clearance for moving that side of the mandible, the whole of the left ramus was removed and the jaw was then shifted as far as possible forward and to the right where it was held by interdental wiring. Two months later, through an incision made just under the chin, the thickest obtainable piece of cartilage was implanted in front of the chin, and a long wedge-shaped piece slid along the right side of the body, the soft tissues at the same time being shifted to the right and sutured in this position.

Figs. 17-*C* and *E* show the result. Notice the mouth line has been made horizontal, the chin is approximately in the midline, the left cheek is less prominent, and the very deforming flatness on the right side of the mandible is almost obliterated.

Fig. 17-*A* shows the profile before the joint resection and the scar of a previous operation.

Fig. 18-*A*. Fig. 18-*B*.

Fig. 18-*C*. Fig. 18-*D*.

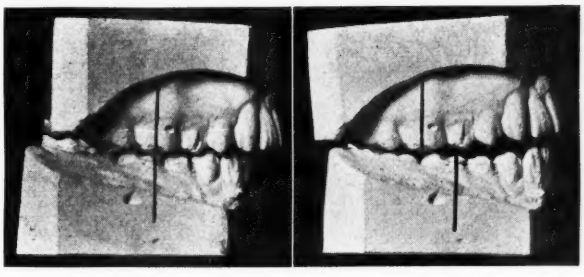

Fig. 18-*E*. Fig. 18-*F*.

Fig. 17-*B*, superimposed tracings, made from the negatives showing the condition before the first operation, after bringing the bone forward and after the cartilage implantation. Notice in Fig. 17-*C* how the lower lip and corner of the mouth have been lifted. When she left the city, she had an incisor opening of 2.5 cm. which will still further improve. The space between the mandibular central incisors was 3 mm. to the right of the midline above.

Correction of External Deformity.—Fig. 18-*A* shows the appearance of a young man who had rickets in infancy, but there was no evident causative factor for ankylosis elicited. At sixteen years of age, he went to an orthodontist, and it was found that he could not open his mouth freely. The facial asymmetry became more evident with subsequent growth. When referred to us by Dr. C. A. Thigpen of Montgomery, Alabama, he was twenty years of age. The chin was well over to the right, as shown in Fig. 18-*A*, and there was a free opening

between the maxillary and mandibular incisors of 1.5 cm. The chin was quite receding. An x-ray picture showed fibrous ankylosis of the right joint. At operation, June 24, 1924, most of the right ramus was removed, and the jaw dragged forward and the jaws fixed with a pine block between the maxillary and mandibular molars on right side with an incisor opening of 3 cm. Block and wiring were removed sixteen days later and subsequently Dr. J. H. Williams put on an orthodontic appliance with a rubber band that drew the right body farther forward and to the left than it was when the block and wires were removed. Fig. 18-*B* shows appearance four months later. His chin and mouth are still slightly to the right, but if a cartilage were implanted the soft tissues would be shifted to the midline as was done in Fig. 17, and his profile much improved. Figs. 18-*C*, *D*, *E*, and *F* show the amount of shifting of the mandible that was accomplished by dragging the right side of the body forward at the time of the ankylosis operation.

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TUMORS IN THE ORAL CAVITY*

By Dr. John W. Seybold, Denver, Colo.

ALL tumors have certain common characteristics; for instance, independence of growth, vitality, function, cause, manner of growth and recurrence.

Their growth is unlimited and uncontrolled except by passive resistance of the invaded tissues.

Tumor cells appear to possess more vitality than normal cells and will grow and multiply while normal cells are atrophying.

As to function: tumor cells are physiologically useless; in fact, they are dangerous to their host.

The cause of tumor formation is not generally known. Irritations have received much attention as a cause, but fail to satisfy scientific requirements entirely.

The growth is entirely by multiplication of its own cells and expresses itself in one of two ways, either by expansion or by infiltration.

It is a well-known fact that tumor operations are occasionally followed by recurrences of the growth, which are due to one or more cells of the growth having been left.

Tumors may be benign or malignant, and the diagnosis is as follows: A benign tumor is one consisting for the most part normal in type, resembling more or less completely the tissue of the part from which it grows. Its growth is generally slow, it is usually circumscribed and encapsulated; it does not recur after thorough removal or reproduce itself in distant parts.

The following benign or innocent tumors are of interest to the dental profession: Fibroma, chondroma, osteoma, multilocular cystic tumors, and follicular odontoma.

Fibroma is a tumor composed of connective tissue cells and white fibers arranged in wavy bundles. It is round or lobulated in form and generally enclosed in a distinct capsule. On section and viewed obliquely it looks like watered silk. It is found on the gum tissues at the neck of the tooth, probably arising more often from the peridental membrane. The diagnosis is made mostly on their slow growth and distinctly nodular outline, also on their consistency, which is less hard than bone or cartilage.

Chondroma is a tumor composed of hyaline cartilage and, according to Bland-Sutton, grows from preexisting cartilage, occuring in relation to the maxillae, they may arise from the cartilagenous septum of the nose. They are encapsulated and nonmalignant, and cause distress only by their size and relations. They occur most commonly in children and young persons and are usually a relatively large size. Pathologically they are to be distinguished

*Lecture given at a joint meeting of the Fort Collins Medical and Dental Societies at Loveland, Colo., Nov. 7, 1928.

from the more rapidly growing, infiltrating chondrosarcomata, which grow to a large size. They should be excised with the cartilage from which they grow.

Osteoma: These tumors are composed of bone, surrounded by a layer or cap of cartilage, therefore ossifying chondromata. They occur on any part of the bones of the face, but probably more commonly on the maxilla than the mandible. They may be of compact or cancellous bone and may be pedunculated or attached by a broad base. They grow very slowly but may attain a large size. As they grow, the soft tissues covering them may ulcerate, leaving the bone exposed. They are painless, but pain may be caused by pressure. When pedunculated they may become detached and be thrown off spontaneously. They are nonmalignant. They should be removed together with a very small area of the bone to which they are attached.

Multilocular cystic tumors (epithelial odontoma) are composed of a number of small cysts lined with cubical epithelium and embedded in a fibrous stroma. They contain a viscid fluid. The jaw becomes expanded and shows no tendency to affect the glands or to dissiminate. They occur more often in the mandible and in young persons.

Follicular odontoma (dentigerous cyst) is a cystic formation which occurs in connection with a misplaced or nonerupted tooth. The expanded dental sac represents the cystic wall. It contains a viscid fluid and the crown of the nonerupted tooth, the root of which is usually fixed to the cyst wall, though sometimes the tooth is loose. With rare exceptions, follicular odontoma forms only in connection with permanent teeth. The tumor grows slowly. Owing to the expansion of surrounding bone, "egg shell crackling" may in the course of time be felt on pressure.

Malignant tumor consists of a perverted type of tissue, i.e., differing from any normal tissue. It generally exhibits extreme activity of growth, increasing in size until the fatal end. It tends to invade the surrounding tissues irregularly, so that there is no sharp division between it and them, encapsulation being exceptional. It tends to reproduce itself in distant parts.

There are two chief kinds of malignant tumors: (1) The sarcoma, which grows from connective tissue; (2) the carcinomata which grow from epithelial tissue. Broadly, there are two clinical types of carcinoma of the jaws: the soft, medullary type which is found in the antrum and oral surfaces of the maxilla; and the hard ulcerating type, which usually appears on the mandible.

The medullary type is usually very soft and is first noticed as a small papule which bleeds easily. As it extends it may take on a cauliflower appearance. It rapidly extends on the surface and into the antrum but does not ulcerate easily. The hard ulcerating type usual to the mandible grows more slowly and in the early stages is painless. The induration and ulceration invade the neighboring surfaces much more rapidly than the deep tissues.

In tumors arising in the antrum or nasal cavity, pain is an early and almost constant symptom. This may be localized in the form of a toothache or be diffused over the distribution of the fifth cranial nerve. As the tumor enlarges, there are symptoms of obstruction of the nasal fossae and the nasal duct. The cheek becomes prominent, and when the external bony wall is perforated, the

tumor may be felt in the soft tissues of the cheek. The skin may become discolored but rarely ulcerates. The tumor may fungate into the mouth.

DIFFERENTIAL DIAGNOSIS BETWEEN:

Sarcoma	Carcinoma
Occurs at any age but most commonly early in life.	Occurs late in life.
May be encapsulated and circumscribed.	Not encapsulated.
Grows more rapidly.	Grows less rapidly.
Lymphatics as a rule not involved.	Adjacent lymphatics involved.
Metastases through blood vessels.	Metastases through lymphatics.
Less apt to form metastases.	More apt to form metastases.
Does not tend to ulcerate.	Tends to ulcerate.

In conclusion I wish to point out that the prognosis for sarcoma and carcinoma of the mouth is not good. As a general rule, the operation becomes more serious the farther back in the mouth the growth occurs.

All patients having abnormal growths in or about the jaws, should be warned that such growths are dangerous, and should be removed immediately to prevent malignancy. If the growth is malignant, the earlier the operation, the better the prognosis.

A METHOD FOR TREATING THE FRACTURE OF THE NECK OF THE CONDYLE

By Dr. A. Y. Russell, Baltimore, Md.

CASE (E. G. B.) No. 508, W. M. Age 29. Accident March 27, 1925.

History.—The patient fell forward striking his chin on a piece of sheet iron which was being pushed by him. He suffered from severe pain in his head, hemorrhage and pain, and was unable to hear in the right ear. He was x-rayed by a physician for the

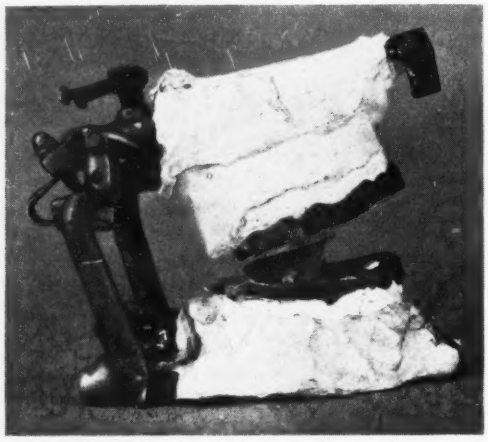

Fig. 1.—Intermaxillary splints with stilts in place.

Fig. 2.—Fracture of the condyloid neck with displacement. Approximation, and best obtainable alignment.

Fig. 7.—X-ray, lateral after treatment.

insurance company, with negative report as to fracture. The case was referred to the hospital, and the patient was under observation for three days. He was x-rayed again, with negative report as to fracture. Patient was discharged from hospital. He reported

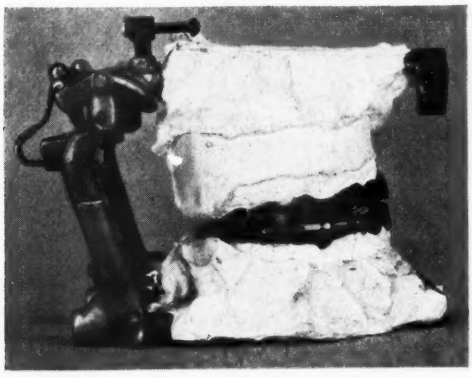

Fig. 3.—Stilts removed. Intermaxillary splints locked in closed position.

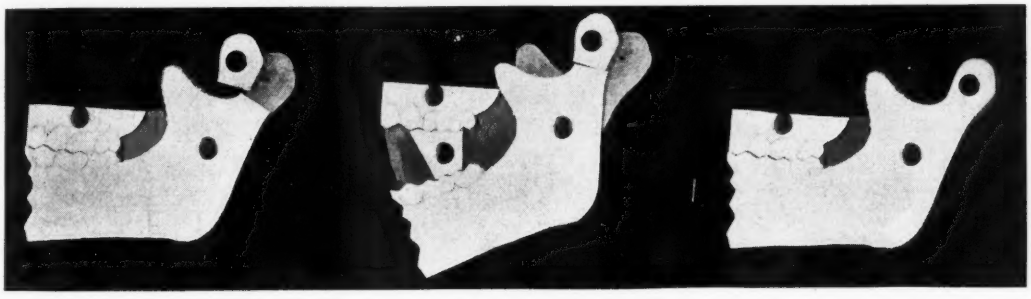

Fig. 4. Fig. 5. Fig. 6.

Fig. 4.—Illustration of fracture of condyloid neck with displacement of the head.
Fig. 5.—With stilts in place to afford approximation and stability.
Fig. 6.—Closed, after union, to carry head back into the glenoid cavity.

Fig. 8.—X-ray, anterior posterior, of left side, before treatment.

Fig. 9.—X-ray, anterior posterior, of left side, after treatment.

to his dentist to have fractured teeth restored. Because of lack of occlusion from displaced mandible, the patient was referred to me for diagnosis.

Examination.—April 3, 1925. Condyloid head on right side was located by palpation in right ear. Crepitation was present upon movement. No condylar head movement on left could be demonstrated. There was some swelling and soreness. The mandible was displaced to the right with little or no occlusion of the teeth.

Radiographic examination revealed fracture of the left condyle neck with upward and inward displacement of head. Fracture of tympanic plate could not be well demonstrated by x-ray, but was present.

Recommendation.—Reduction of fracture by intermaxillary splints with stilts. (The stilts were to be used to stabilize the mandible and to produce better alignment of fracture and to move the condyloid head forward out of the fractured tympanic plate.)

The patient was referred by the physician to be x-rayed again, and fracture of condyle neck on left side and fracture of tympanic plate right side were reported. Dental consultation was called, no treatment recommended because the opinion was given that "treatment will not be beneficial, and if treated patient will have a stiff jaw due to the fractured tympanic plate."

The patient came back to me. My above recommendation was carried out. (Fig. 1.) Intermaxillary splints were constructed and cemented to place. (Fig. 2.) X-ray showed fractured ends approximating but not in perfect alignment. (Fig. 3.) Three weeks later stilts were removed and rubber bands applied to assist the teeth and jaws to assume former relation. Usual stiffness due to disuse, occlusion good. Fig. 4 illustrates fracture of the condyloid neck with displaced head. Fig. 5 shows stilt in place allowing enough approximation for union. Fig. 6 shows stilt removed, mouth closed which carries head into the glenoid cavity. Use assists the head to assume its normal position and good alignment. (Fig. 7.) After treatment good alignment. (Fig. 8.) Anterior posterior x-ray shows fracture and displacement. (Fig. 9.) After treatment.

The x-rays were made as nearly as possible at right angles to show the alignment from two positions.

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

Edited By
Clarence O. Simpson, M.D., D.D.S., F.A.C.D.,
and Howard R. Raper, D.D.S., F.A.C.D.

A DISCUSSION OF METHODS FOR DEVELOPMENT OF RADIODONTIC FILMS

By Mr. Millard B. Hodgson,* Rochester, N. Y.

I HAVE just read, carefully, Dr. Simpson's article in the June, 1929, issue of the International Journal of Orthodontia, Oral Surgery and Radiography, and I am considerably surprised at the position he takes with reference to standardization and manufacturers' efforts in the dental field.

I feel certain that a major portion of the dental profession today believes that a great deal of at least the mechanical and technical progress of the past decade has been due to the close cooperation of the dental profession and the American manufacturers. Undoubtedly there may be what might be called unethical manufacturers, the same as there are undoubtedly unethical dentists and physicians, but the tone of Dr. Simpson's article seems to impugn the motives of any manufacturers back of standardization in dental radiography.

I have always felt that our position in the field gives us a peculiarly valuable viewpoint on the needs of dentistry, so far as radiography is concerned, getting, as we do, a cross-section study of the entire dental profession, the public, the distributors, and the manufacturers.

Now it seems a step backward to assume a premise that modern scientific methods and basic principles cannot be applied to dentistry as well as to any other science, for undoubtedly the nearer any profession comes to an exact science as distinct from the arts, the sounder will be its practice.

To state that because the element of anatomy, and possible pathology, enters into the making and interpretation of dental radiographs, it prohibits standardized phases of technic does not seem sound to me and a great many others.

Consider, for example, development alone. Statements of the Eastman Kodak Company on developers and development are not based on individual experience or hearsay; they are the results of collaborated research over a great many years—not only research on the chemical reactions involved, but a study of the practicability of applying these basic chemical truths. There-

*From the Eastman Kodak Company, Rochester, N. Y.

fore, when we state that technic is best when development is made for five minutes at sixty-five degrees, we know whereof we speak. It is best.

It is true, as Dr. Simpson states, that there is gradual exhaustion of developer and that an optimum time of five minutes only applies to "fresh" developer, but exhaustive experiments have shown that in dental radiography so many dental films may be developed at a time of five minutes without sacrifice of quality, that calibrating the tank, prolonging subsequent development for six, seven and eight minutes, is neither necessary nor economical. For example, twelve ounces of solution, with about three ounces of fresh developer added from time to time to maintain level, will develop more than ten dozen dental films, with no practical variation in density, at five minutes, at a cost of one cent per dozen! Larger quantities (one-half gallon to one gallon) develop considerably more than a proportional number.

Surely with a system having two variables—exposure and development—if one variable can be changed to a constant, the resultant condition is better. If judgment of exposure technic is as difficult as Dr. Simpson outlines, then all the more should the dentist be relieved of the variable factor of development in order to concentrate on proper exposure determination. So much for theory.

It has been my experience to come in contact personally with a great many dentists doing dental radiography, and I have never yet seen more than two or three who could routinely "juggle" exposure and development both. Furthermore, these few, I am sure, if they practiced standardization, would do just as good—maybe better—work, or at least they would get their good results easier.

The photographic technical publications are full of authoritative literature on the efficiency of standard development.

Inspection development, as advocated by Dr. Simpson, is most difficult and has, in my mind, been a greater cause of poor dental radiography than any other one thing. It requires really years of experience to be done effectively. Undoubtedly Dr. Simpson can do it, but the entire American public cannot be x-rayed by Dr. Simpson or other radiodontists of similar skill.

The average dental patient or client must get the benefit of radiography from his so-called family dentist. It may be a full set, or occasional studies of individual teeth as they are worked on. Such a dentist rarely has the time or cases sufficient to enable him to gain proficiency in inspection development—nor does he have to.

Let us suppose he attempts it, granting that at least developer temperature is sixty-five degrees. If he has been working under a bright light, his eyes will take a considerable number of minutes before they are adapted to the darkness. His visual acuity is very low when he shuts himself in the dark room. The film after one minute looks rather black, so he puts it in the fixer. Imagine his surprise when the lights go on to find practically no image! Yet such are daily occurrences. We have had hundreds, perhaps thousands, of letters stating, "The films were good until put in the fixer, then the image dissolved!" Or, suppose the exposure is weak, and three, four or five minutes pass without appreciable darkening, there are repeated inspections in a small

room, doubtless in close proximity to a safelight, and the negative is finally produced flat and foggy, either from light or aerial oxidation or both. We have investigated many of them and found—inspection development.

"The proof of the pudding, etc."—Due to an increasing demand for it, we recently established, as a part of our Educational Department at Rochester, N. Y., a course in dental radiography. This course is under the supervision of Ralph S. Voorhees, Jr., D.D.S., who is also on the staff of the Rochester Dental Dispensary. It also has had the benefit of Dr. Harvey J. Burkhart's vast experience in dentistry. It applies the technical experience of the Kodak Research Laboratories.

To date about one hundred and seventy-five students have taken the course; some of them men who have had considerable experience in dental radiography, and some with very little.

Standardized positioning, exposure and development technic are demonstrated and later practiced by the student. Each student finally makes a full mouth examination and a bite-wing set. Of some three thousand five hundred negatives made to date, less than one per cent has been of other than good diagnostic quality; these by people working in a strange environment under the eyes of others, using, many of them, standard methods for the first time.

The results have been so striking that a number of leading dental schools plan, in cooperation with Dr. Voorhees, to adopt the essentials of the course.

During these few months a good many intelligent dental authorities have visited us, or corresponded with Dr. Voorhees, and seem to appreciate that this, or something similar, is the way to make dental radiography applicable to dentistry.

Perhaps Dr. Simpson's conception of just what constitutes standardized radiography and our own are not the same thing. Certainly our experience over a great many years teaches us that the kind of standard treatment we advocate is more advantageous to the dental profession and the public as a whole than the artistry of the Simpson system can be in the same hands.

As maufacturers we are particularly jealous of our close contact and many sincere friendships and cooperation with American dentists and physicians. We believe we have contributed something to both, and, therefore, a reference to "glorified alarm clocks" is not particularly pleasing. I am sure, though, that this is more a result of Dr. Simpson's particularly gifted literary style than intentional affront.

It has been our experience that there is quite a permissible range in density in x-ray negatives of the same subject in which diagnostic detail is readily apparent in all the negatives in the series. Were this not so, a great many of those today attempting development by inspection would be severely handicapped. If standard development results only just came within this range, then its value would be sufficient, but followed definitely, results come well toward the *center* of the range.

It has not been our experience that, keeping development standard, there is much likelihood, if standard positions and exposure times are followed, of exposure error throwing the negative beyond tolerable density limits. That

leaves the only real variable, then, to be the correction that anatomic variation in the patient from the normal (standard) seems to make necessary. It is a variable that is recognized in any reputable standardized radiographic teachnic, whether dental or medical. This correction may be one of position or time or both. Usually it is not a case of the "standard" technic being hopelessly wrong, but simply means a slightly better negative.

In our course here the matter of deviation from normal technic to correct such conditions as interference due to the shadow of molar process, is so regularly demonstrated that it is almost "standard."

Nomenclature in suggesting a range of exposures with patient is not of importance, whether graded as light, medium, heavy or other ways. What is desirable is to call attention to a probable range in exposure for all patients, and pointing out that, generally speaking, the heavy exposures are indicated on patients with thick muscular or bony tissue between the tube and the film.

Dr. Simpson compares the dental radiograph to radiography of the hand. Surely no one could seek a subject more easy to ray correctly, so far as exposure timing goes, than the hand. Even a novice should obtain a diagnostic negative; and it has been our experience that so far as obtaining clear-cut negatives of the teeth is concerned, dental radiography can be made equally as simple.

Interpretation is another matter, but so surely as good negatives are readily obtained routinely, just so much more likely is the dentist going to learn to correlate anatomic and pathologic conditions to their x-ray images.

I recently had an opportunity of seeing a day's work at one of the country's leading dental institutions, where the day's output of radiographic examinations is probably more than that of any ten individuals in the country. The quality of negative produced was *uniformly* good in exposure—in no case were there errors of anything like the order Dr. Simpson lists for his friends—and development was absolutely standardized by the time-temperature method.

In conclusion, Dr. Simpson states that manufacturers—of x-ray equipment—and *films*—create the impression that no additional knowledge other than operating the machine is necessary for them to practice radiodontia. Certainly we as film manufacturers have striven to give just the reverse impression; that while routine radiography—the making of negatives—may be made relatively simple, the published works of outstanding diagnosticians should be studied and current literature followed, and this knowledge applied to their own films in order to work up capable diagnostic ability.

A REPLY TO MR. HODGSON'S DISCUSSION

By Dr. Clarence O. Simpson, St. Louis, Mo.

IT IS not unusual for there to be a difference of opinion between the manufacturer and the practitioner, because their viewpoints and problems differ. The manufacturer produces and recommends that which he believes will please the majority, and then by advertising he endeavorers to convince the minority. The practitioner, in striving for efficient results, finds that he must adapt apparatus and materials to his methods and the characteristics of his patients. The recommendations of manufacturers cannot always be followed successfully, and the practitioner must decide upon the method which best serves his purpose.

One who does not practice radiodontia may assume that standardized development is as attractive in practice as it is in theory. However, anyone who is familiar with general results knows it is not, and it has had a thorough trial. The submitted proof of this conclusion was test exposures made by four dentists, each with more than five years experience in radiodontia. The errors of exposure ranged from 20 to 60 per cent, which are beyond the practical limits of standard development. This handicap should not prevail, merely to support a theory, when it can be eliminated.

In the article under discussion, the attempt was made to present logically the advantages of inspection development. The plea was made for earnest effort to calculate exposures correctly and to develop the standard time whenever possible. The only exception suggested was to inspect the films occasionally during development and to compensate by development time for unavoidable errors in exposure. This method is not juggling but endeavoring to adapt a process to a variable factor, instead of accepting the variations to maintain an inflexible standard. The objective is to produce interpretable radiographs, and if any research department will discover a method of determining the correct exposure for each region of each patient, standardized development will be applicable.

There can be little difference in conceptions of what constitutes standardized radiography, but there is a vast difference in conceptions of radiographic standards. Radiodontic standards will not be raised by opposing technical refinements, the advantages of which have been demonstrated. Also, it is a pertinent question whether dentists are to be instructed by the faculties of dental schools and experienced clinicians in the profession or by the manufacturers.

In the Washington University School of Dentistry, the students after a didactic course of one year are given charge of the radiodontic department during their senior year. The grading of all their radiographs shows that development by inspection is the easiest technical phase of radiodontia for them to learn; although diagnostic quality for over 99 per cent is not claimed. The method described in the article was proposed with no other object than to render radiodontic service better and easier. It is immaterial who agrees with it or uses it, but anyone can test the comparative efficiency of the method by carefully following the directions for a few days.

ABSTRACT OF
CURRENT LITERATURE

ORTHODONTIA — ORAL SURGERY — SURGICAL ORTHODONTIA
DENTAL RADIOGRAPHY
BY DR. EDWARD PREBLE, New York City

NUTRITION AND PEDIATRICS
BY SAMUEL ADAMS COHEN, M.D., NEW YORK CITY

It is the purpose of this JOURNAL to review so far as possible the most important literature as it appears in English and Foreign periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the publishers.

Orthodontia, Oral Surgery, Surgical Orthodontia, and Dental Radiography

Orthodontia for the Adult. J. N. Pike. Dental Survey, October, 1929.

Very little is done in adult orthodontia, and both dentists and the public are prone to look upon this subject as applying only to the child and adolescent. When an adult patient loses a six year molar and neglects to have a bridge applied at once, when this is practicable, the adjacent teeth become tilted. It is quite possible to bring them back to their original position by means of ordinary orthodontic resources yet how seldom does this happen! It is true that this works out much better in the maxilla than in the mandible, yet it can be accomplished with time. If this molar is lost comparatively early in life and many years have elapsed, it will be advisable to extract some of the worst of these badly tipped teeth. In inserting a bridge it may be possible to make some preliminary use of orthodontia, as bridges do not as a rule rest well on inclined teeth. To take an entirely different type of case—the man of middle years who has retained his teeth and has no gum disease, yet whose maxillary teeth protrude with impingement of the condyles on the external auditory meatus causing disagreeable symptoms—orthodontia may accomplish something although often contraindicated, in which case prosthesis must be the resort. In still another type in which the mandible is in a position mesial to the maxilla, spectacular results may be obtained by orthodontia, for here age cuts no figure. In a fourth type in which there have been multiple extractions in different parts of the mouth, with much tilting of the adjacent teeth, orthodontia may also be of service. In all of these cases close-bite is present, whether due to extraction or improper position of the mandible. In all types there is incorrect joint position. Orthodontia can do some of the work now performed by the prosthodontists and can also be made to assist the latter.

Caries and Pyorrhea. Editorial in the Dental Surgeon, Oct. 5, 1929.

The familiar teaching that these two affections are so unlike that they seldom coexist no longer has any foothold in fact, however much it may impress itself on the casual observer. It is true that caries is primarily a disease of childhood and pyorrhea of mature years and that those who seem partly immune to caries show no immunity to the other malady. But carefully compiled statistics give results quite contrary to the doctrine so often found in modern periodical literature. Among those who have gone to much trouble to learn the exact truth, an American, Dr. Tischler, is well worth quoting. This dentist took 200 cases of pyorrhea as they came in his practice, without any attempt at selection. The total number of teeth in this series was about 5000. Only 2 of the 200 pyorrheics were absolutely free from caries—1 per cent. The total number of cavities found in the 5000 teeth was 2675, surely a sufficient answer to the claim that the teeth of pyorheics have considerable immunity to caries. There was no parallelism between the two diseases, for patients with marked caries could suffer only slightly from pyorrhea and vice versa, and those who showed pockets due to pyorrhea did not suffer more from caries than those who were free from them. There is no doubt that the same conditions predispose to both diseases—irregular and overcrowded teeth in the interstices of which food is prone to lodge and stagnate, and certain general conditions which affect the vitality of the individual.

Increase in Vincent's Disease. Editorial in The Pacific Dent. Gaz. **37**: October, 1929.

According to Dr. Endelman there has been for some time an alarming increase of an insidious character of this stomatologic affection. This is noted especially as a complication of other infections of the gums. While acute Vincent's gingivitis is readily recognized the reverse is the case with the chronic form. Nearly every case of pyorrhea which begins as gingivitis is complicated by a Vincent infection as shown by the presence of the two causal organisms, and in one recent bacteriologic survey the complication was present in 90 per cent of all cases of pyorrhea examined. This superinfection is also liable to develop in untreated mouths and is much more rare in patients with all the benefits of prophylactic and restorative dentistry—crown and bridge work. Conversely the early loss of teeth in relatively young persons must often be set down to Vincent's infection supervening in neglected mouths. Some stomatologists do not hesitate to style this form of infection as a pure filth disease, although it may supervene in its acute form in the eruption of third molars and other teeth. In the management of the acute case bactericides should suffice, but in the chronic forms the entire mouth must be put in order. It is only fair to state that in the practice of some dentists the disease occurs in mouths which are clean. Office practice does not agree in this respect with the findings in free dispensaries. In the experience of certain dentists mouth hygiene cuts no figure at all as a factor. But if the infection can develop in clean mouths, it stands to reason that it should be much more common and severe among the proletariat than in those who use the tooth brush.

Agranulocytic Angina. S. W. A. Franken and O. Hensel (New York). Dental Cosmos **71**: November, 1929.

The fact that this form of sore throat is usually accompanied by lesions of the mouth makes it of interest to the stomatologist. The fact that the affection is almost 100 per cent fatal may serve to place a considerable responsibility upon the dentists. The authors (Dr. Hensel is a physician) report two cases seen at Lenox Hill Hospital. It must be borne in mind that the disease has only been known since 1922 and that up to last year over 125 cases had been placed on record. The first patient, a man, thirty-one years old, in apparently good health, had had a premolar extracted, and the subsequent appearance of an ulcer in the retromolar triangle was ascribed to a Vincent infection. All crowns and bridges were removed, and the condition seemed to be healing properly. But at this juncture tonsillitis set in on the same (left) side of the mouth with intranasal ulceration and signs of acute infection of several teeth. An abscessed mandibular right premolar was extracted with apparent improvement. The diagnosis appears to have been a Vincent infection with multiple lesions. Sepsis set in abruptly, and despite all treatment the patient died. Diagnosis was made by exclusion of other throat infections and by the blood counts which are peculiar to agranulocytic angina. No bacterium could be isolated anywhere which could throw light on the nature of the sepsis. The second case occurred in a woman, seventy-eight years old, who first developed peculiar sores in the mouth. No angina was mentioned, but the cervical and other superficial lymph nodes were swollen. Vincent and other known organisms were not present, and after two weeks the fever curve became distinctly septic, ending fatally in another week. The authors, like others who have studied these cases, believe the condition to be a syndrome rather than an autonomous disease, as shown by the absence of anything like a specific cause.

Bismuth Stomatitis. Editorial in the Dental Surgeon, October 26, 1929.

With the introduction of bismuth into the routine treatment of syphilis the stomatologist must bear in mind the possibility of a bismuth stomatitis. The liability of the patient to this complication is not great, at least in English-speaking countries where not much of the metal is given intravenously and the doses are not large, and beyond an occasional bismuth blue line on the gums the dentist is not likely to be reminded of the subject. But one actual case of bismuth stomatitis is mentioned as reported in the *Dental Cosmos*. This occurred in New York, and the patient had received intramuscular injections of potassium bismuth tartrate containing from 60 per cent to 70 per cent of the metal. The patient, a woman, twenty-nine years old, had contracted syphilis in 1921 and had shown an idiosyncrasy against arsphenamine. Bismuth was first given in 1925 and after prolonged exhibition of it she developed salivation, dysphagia, trismus, tenderness over all the roots of the mandibular teeth, blurred vision, severe headaches, vertigo and nausea. The gums showed the typical blue line, and the tongue was swollen and ulcerated, while there was similar ulceration about the third molars and on the tonsils, fauces and soft palate. There was high temperature, insomnia and mental

disturbance. Stopping the bismuth was not sufficient for recovery, and sodium thiosulphate was administered by intravenous injection, while 5 per cent mercurochrome was applied to all the ulcers after the sloughs had come away. Even under this regimen she required three weeks for complete recovery. The crucial point in this theory was the sudden supervention of the picture without any warning.

Impacted Teeth. W. Lintz (Brooklyn). Dental Cosmos **71**: December, 1929.

The author writes from the angle of the general practitioner of medicine and gives two tabulations of personal cases. In the first, 18 patients of both sexes presented 42 unerupted teeth with a great predominance of an upper lateral incisor (23) which the author assumes to represent a defect of development akin to harelip and cleft palate. Again this malformation is akin to the opposite one of supernumerary teeth and very closely related. Other anomalies of growth and development seem of more than ordinary frequency in these subjects, but the author is interested chiefly in those of apparent endocrine motivation. The chief factor under this head is anomaly of the thyroid function, either of hyper- or hypothyroidism or a mixed condition with occasional enlargement of the gland. The author is inclined to look on unerupted and supernumerary teeth as a manifestation of thyroid disturbance of some sort. Timme, the neurologist, who is an authority on endocrine anomalies, looks on anomalous maxillary lateral incisors as a pluriglandular manifestation in which some of the glands exhibit a compensatory overaction; but the author's finds do not all agree with those of Timme who outlines certain syndromes which are not represented in the author's material. Kaplan on the other hand associates maxillary lateral incisor defect with the gonads. The author found much menstrual irregularity in the female patients but nothing corresponding in the male, although some of the men had had mumps. Female patients are about twice as common as males, and about 5 per cent of 350 examined showed failure of eruption. The number of cases of supernumerary teeth was but 3, and of the 21 patients with one or the other deformity there was a loss of 67 teeth by caries or extraction, molars showing much the greatest frequency, followed by premolars.

Mummification. L. M. Berman (New York). Dental Items of Interest **51**: November, 1929.

The author refers to the revolutionary paper on this resource by Hess of Zurich. The subject is far from new, for mummification has been practiced in some form for thirty years. Hess seems to have proved that this way of treating pulp and root fibers is of the same value as extirpation, although it is restricted to normal or slightly affected tissues. But in the author's opinion this restriction practically makes the method of no actual value, for it is the infected and putrescent pulp which makes the appeal. At present no line can be drawn between indication and contraindication, although one might insist that the root fibers be intact no matter what the state of the pulp proper. Putrescence with focal infection would be outside the pale. In the present paper the author appears to deal with root fibers chiefly, the pulp

having already been removed. If the root fibers are vital, it is a case for mummification. In a three root molar every root must be vital. The pulp may be destroyed by arsenic in such a manner that the roots are left vital. Then all the coronal pulp tissue is to be removed in the usual manner, along with whatever tooth structure is desirable. There should be a delay not to exceed three days before mummification. The technic of the latter is somewhat complicated, and the time required is about one and a half hours. No choice of material is given, for the author only mentions a proprietary paste. After the act of mummification a cement filling is inserted. Teeth thus treated have all the advantages of vital teeth. There is no discoloration, and they are not as brittle as dead teeth with filled root cavities. The total time required is about equal to that used in extracting pulp and filling root canals.

Nutrition and Pediatrics

The Rôle of the Banana in the Diet of Infants. L. Von Meysenberg. New Orleans M. & S. J. **82**: 2, 1929.

The author again emphasizes the banana as a valuable article of food for the infant. Infants of four or five months are fed one teaspoonful of the mashed pulp of banana, and if it is well tolerated, Von Meysenberg gradually increases the amount until the infant takes from 6 to 8 teaspoonfuls of banana daily.

The selection of the right kind of banana is essential for successful feeding. The banana must be thoroughly ripe, that is, it must be entirely yellow with black spots on the skin. It may also be brown provided the pulp itself is not mushy or brown. It is desirable to have the banana macerated through a fine wire mesh sieve.

The ripened banana, which has a plentiful supply of vitamines A, B, and C, contains 11 per cent glucose, 8 per cent sucrose, 1 per cent starch, less than 1 per cent protein and hardly any fat. It excels all other fruit except strawberries in its iron content. The caloric value of the banana is 447 calories per pound or one calorie per gram.

The Effect of Variation of the Diet in Rheumatic Children. A. P. Thomson and S. H. Edgar. Arch. Dis. Childhood **4**: 21, 1929.

These authors studied the effects of diet on 22 children living under identical conditions who were convalescing from rheumatic fever. One group of children was given a high protein diet, and a second group was given a diet rich in starch.

After observing these groups for five months the authors state that there is hardly any difference in the two groups in regard to their clinical progress, nor was there any appreciable difference noted in their blood chemistry. From their investigation they feel that the diet has no material importance in the etiology or cause of rheumatism in children.

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EDITORIALS

Group Life Insurance for the American Dental Association

AT the meeting of the American Dental Association at Minneapolis in 1928, the delegates from the Kansas State Dental Association presented a proposition to the house of delegates regarding group life insurance for the members of the American Dental Association.

This request was made because several state dental associations had investigated the feasibility of different state societies being granted insurance under a group policy. As a result of the investigation carried on by the Kansas State Dental Association, it was found that if the American Dental Association could be induced to take out a group policy, the cost of insurance to the individual members would be much less than to members of a state organization.

The plan had been carefully studied and outlined by Dr. Homer B. Robison, at that time president of the Kansas State Dental Association, and Dr. Fred A. Richmond, secretary of the aforenamed association. As this plan necessarily involves expenditure of money by the individual members of the American Dental Association and not by the association as a whole, the matter was referred to the board of trustees for investigation. In time it was referred to the attorney for the American Dental Association. In order to ascertain the infallibility of this plan, the matter was brought to the attention of attorneys in different sections of the country and to insurance brokers who were in no way financially interested in the proposition. These attorneys and brokers pronounced the plan safe and sound.

Some members of the board of trustees became very enthusiastic over the plan and wanted it to be put into effect at once, so that the members of the American Dental Association who were approaching the age limit could take advantage of the insurance before the meeting at Washington in 1929. However, some of the men who had been members of the house of delegates at Minneapolis advised that the matter be again referred to the house of delegates for final adoption.

At the first meeting of the house of delegates at Washington, the board of trustees brought in a report in favor of the group insurance plan. The committee on rules and order moved that this report be made a special order of business for the afternoon. When the time arrived, the plan was adopted by the house of delegates without a dissenting vote.

In brief, the plan allows any member of the American Dental Association between the ages of twenty and sixty years inclusive to obtain $3000 worth of insurance for an annual payment of $33, between the ages of sixty-one and sixty-five inclusive to obtain $1000 for an annual payment of $11. This insurance can be obtained without a medical examination, provided the individual is engaged in the practice of dentistry. The money becomes payable in the event of permanent disability before the age of sixty. Life insurance in the American Dental Association will thus become a great help to the Relief Commission of the American Dental Association.

In order that this insurance might operate, 25 per cent of the eligible members must make application for it. As many of the members of the American Dental Association are fast approaching the age limit, and in order that they may avail themselves of the advantages of this insurance, we suggest that they comply with the request of the insurance committee and apply for the insurance under this group policy at once. In fact, we urge the general membership to do likewise.

The following is a quotation from a letter received by the insurance secretary from a very prominent member of the dental profession: "I think that your plan is an excellent one and consider it one of the most valuable contributions to the economic welfare of the profession made by any of the committees of the American Dental Association. It should help very materially to solve the relief problem."

We also believe that this life insurance under the group policy plan as worked out under the guidance of Dr. Robison and Dr. Richmond is one of the outstanding achievements of the American Dental Association.

NEWS AND NOTES

American Society of Orthodontists to Meet in Nashville

The American Society of Orthodontists will hold its twenty-ninth annual meeting at the Noel Hotel, Nashville, Tennessee, April 8, 9, 10 and 11, 1930. An attractive program is being secured, and this meeting should be one of extreme interest to every member of the Society.

A cordial invitation is extended to all ethical dentists who are interested in orthodontia. There will be a registration fee of $10 for non-members.

Oren A. Oliver, president,
Nashville, Tennessee.
Charles R. Baker, secretary-treasurer,
636 Church Street,
Evanston, Illinois.

True Southern Hospitality Awaits Orthodontists at Nashville
Convention City Will Be at Best During April

In springtime the beautiful and romantic South is at its prettiest, and the American Society of Orthodontists has selected one of the most historic and romantic spots in the South, Nashville, Tennessee, as the convention city for 1930. The date has been set for April, and Nashville will do itself proud in its entertainment of the society; especially as one of its own citizens, Dr. Oren A. Oliver, is president of the organization.

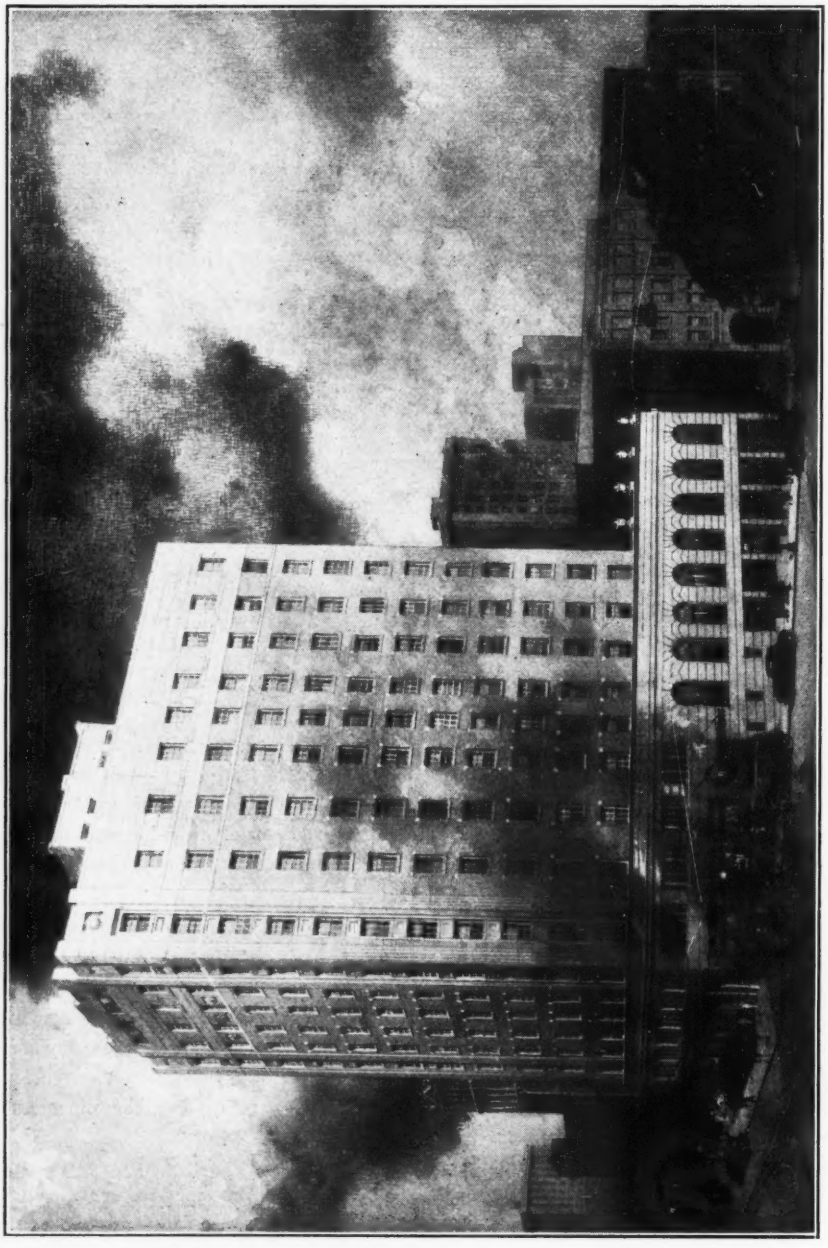
Since the days when Andrew Jackson and his stalwarts roamed the hills and valleys of the beautiful middle Tennessee basin, southern hospitality has always been noted, and Nashville has been the seat of this. The changing of the time and the modernization of present-day customs and progress have made their advent into Nashville, yet this historic old city mingles the old with the new, and visitors always feel that they are welcome and at home in the "Athens of the South."

Nashville of today is one of the foremost and progressive cities of the country. It has an atmosphere about it that instantly gets into the visitor and a charm and friendliness that no one can resist. It is a city of 139,600 population within its city borders and an additional 30,000 in the densely populated suburbs. Beautiful buildings are in its down-town district, and its residential section is one of beauty and simplicity, the homes ranging from the stately old colonial mansions to the less pretentious but appealing bungalows, surrounded by shade trees, flowers and well-kept lawns; its public buildings are among the most noted in America. Nashville in April is at its best.

Lying in the great middle Tennessee basin, surrounded by the foothills of the Cumberland Mountains, with the winding Cumberland River flowing through the city, Nashville is the central figure of the great Volunteer State. It has 23.5 square miles within its border and is 500 feet above sea level; has a mean temperature of 60 degrees, the average summer temperature is 78 degrees and the average winter temperature 41 degrees; the average rainfall is 47.2 inches; the humidity is moderate, and no sunstrokes have ever been recorded in the city. Its springtime is delightful, and April 8, 9, 10 and 11 are most ideal convention dates.

Nashville has 395 miles of streets, 285 miles of water mains with additional miles now being placed in the ground, 238 miles of sewers, 263 miles of gas mains, 34,016 telephones

and nine bridges crossing the Cumberland River. The city park system embraces twenty-one parks and playgrounds containing 2,464 acres of land. Warner Park is one of the most beautiful natural parks in America and is located in the Harpeth Hills, just south of the city; and Shelby Park is another park with natural beauty and ruggedness and contains one of the finest and most sporty eighteen-hole municipal golf links to be found anywhere. In



THE HOTEL NOEL CONVENTION HEADQUARTERS

Headquarters for the American Society of Orthodontists for its convention in Nashville, April 7, 8, 9 and 10 will be at the new Hotel Noel, just completed at Church Street and Fourth Avenue. This hotel was opened January 1 and is one of the most convenient and best arranged hotels of the city. The sessions of the convention will be held in the ballroom of the hotel.

Centennial Park stands the only exact replica of the old Athenian Parthenon to be found in the world. Nashville has a water supply that is pure and inexhaustible, and a new filtration plant of the latest and most improved type has just been installed. The city has four Carnegie Libraries, 273 churches and proper convention halls for handling large gatherings.

HOTEL FACILITIES

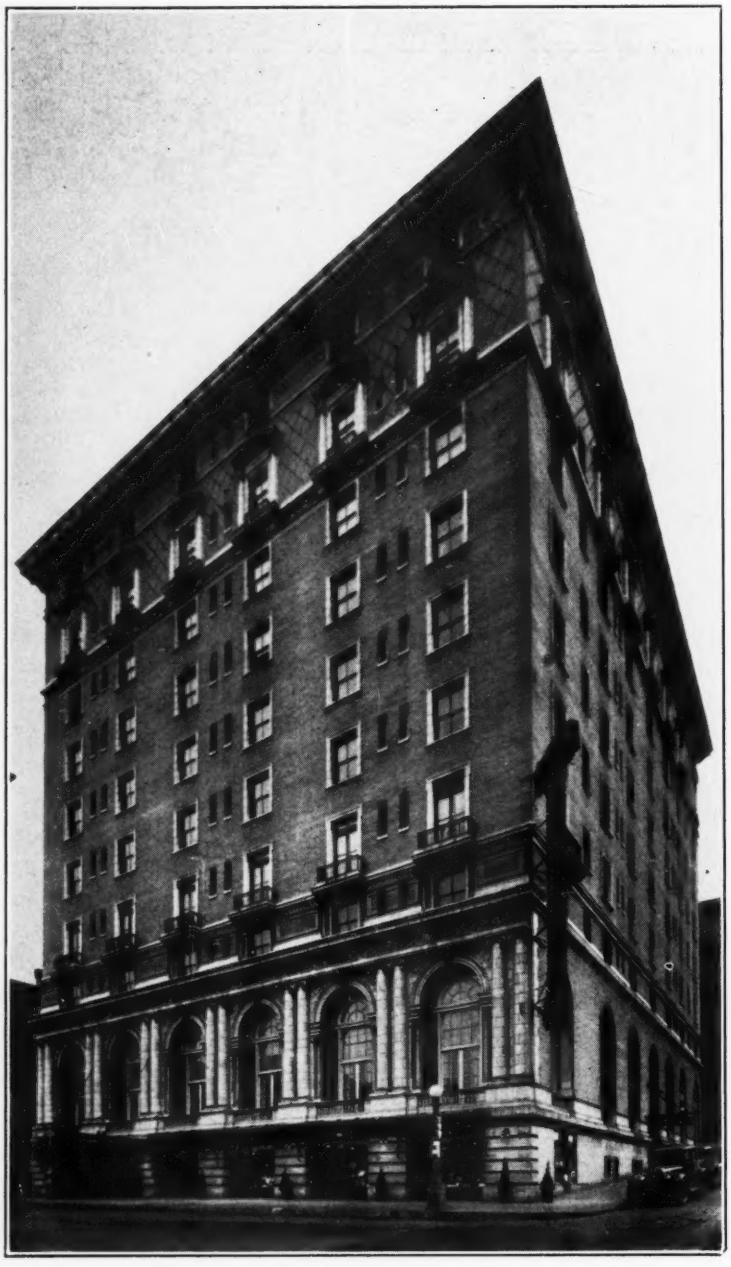
The hotel facilities of Nashville are ample, and some of the most modern hotels of the South are in this city. The new Noel Hotel, just being completed, will be headquarters for the convention and is located in the heart of the down-town district, at Fourth Avenue and Church Street. This hotel has 231 rooms, all with bath, and the rates range from $2.50 per day up. The Assembly Hall of this hotel will be used for the sessions of the convention.

THE ANDREW JACKSON HOTEL

Located at the corner of Deadrick Street and Sixth Avenue, overlooking Memorial Park Square, and one of the South's leading hotels.

In addition the other hotels of Nashville are conveniently located to the Noel, the greatest distance from any being five blocks. The Andrew Jackson Hotel at Sixth Avenue and Deadrick Street has 400 rooms, all with bath, and rates are $2.50 per day and up; the Hermitage Hotel, Sixth Avenue and Union Street, 250 rooms, all with bath, $2.50 per day

and up; Sam Davis Hotel, Seventh Avenue and Commerce Street, 200 rooms, all with bath, and all rooms being $2.50 per day; the Maxwell House, Fourth Avenue and Church Street, 200 rooms, rates for those with bath being $2.50 per day up and without bath $1.50 per day; the Tulane Hotel, Eighth Avenue and Church Street, 200 rooms, with bath $2.00 per day and up, and without bath, $1.50 per day and up; Savoy Hotel, Seventh Avenue just



THE HERMITAGE HOTEL

One of Nashville's groups of hotels, located in the business district and considered one of the South's finest and most hospitable hotels.

below Church Street, 75 rooms, with bath $2.00 per day and up, and without bath $1.50; the Ansley Hotel, 905 Broadway, rates $1.25 to $2.00. In addition the James Robertson Apartment Hotel, Seventh Avenue just below Commerce Street, has 75 rooms for transients, all with bath at $2.50 per day and up.

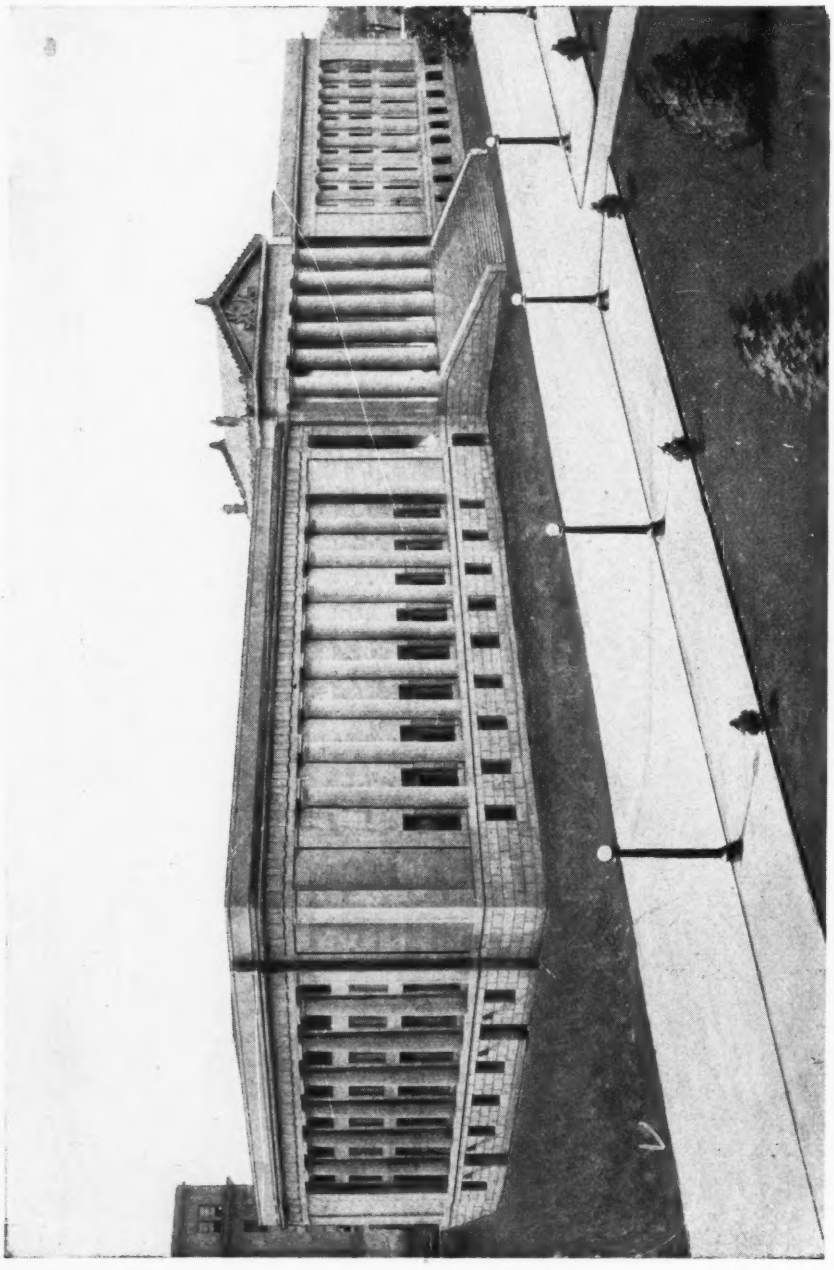
Nashville's down-town district has, for the past few years, been undergoing an almost complete change. The skyline of the city has become filled with tall buildings, most of these are new and all are modern in every respect. The erection of the magnificent Tennessee War Memorial Building, located on Capitol Boulevard between Commerce and Cedar streets and one of the most imposing buildings of the city, was the beginning of a building era for

THE SAM DAVIS HOTEL

Most unique in that it has but one rate "Room and a Bath, $2.50." Located at Seventh Avenue and Commerce Street, opened one year ago and proving one of the most important in the city.

Nashville that has extended into all parts of the city. Especially is this true of the down-town district. This building occupies two city blocks in the heart of the business section and faces two additional blocks that have been turned into a city park. This was constructed jointly by the State of Tennessee, City of Nashville, and Davidson County at a

cost of $3,500,000. Since its erection other notable buildings in the down-town district have been the Andrew Jackson Hotel, the American Trust Building, the Nashville Trust Building, the Bennie-Dillon Building, the Caldwell Building, the Noel Hotel, the Sam Davis Hotel, the James Robertson Apartment Hotel, the Medical Arts Building, the National Life



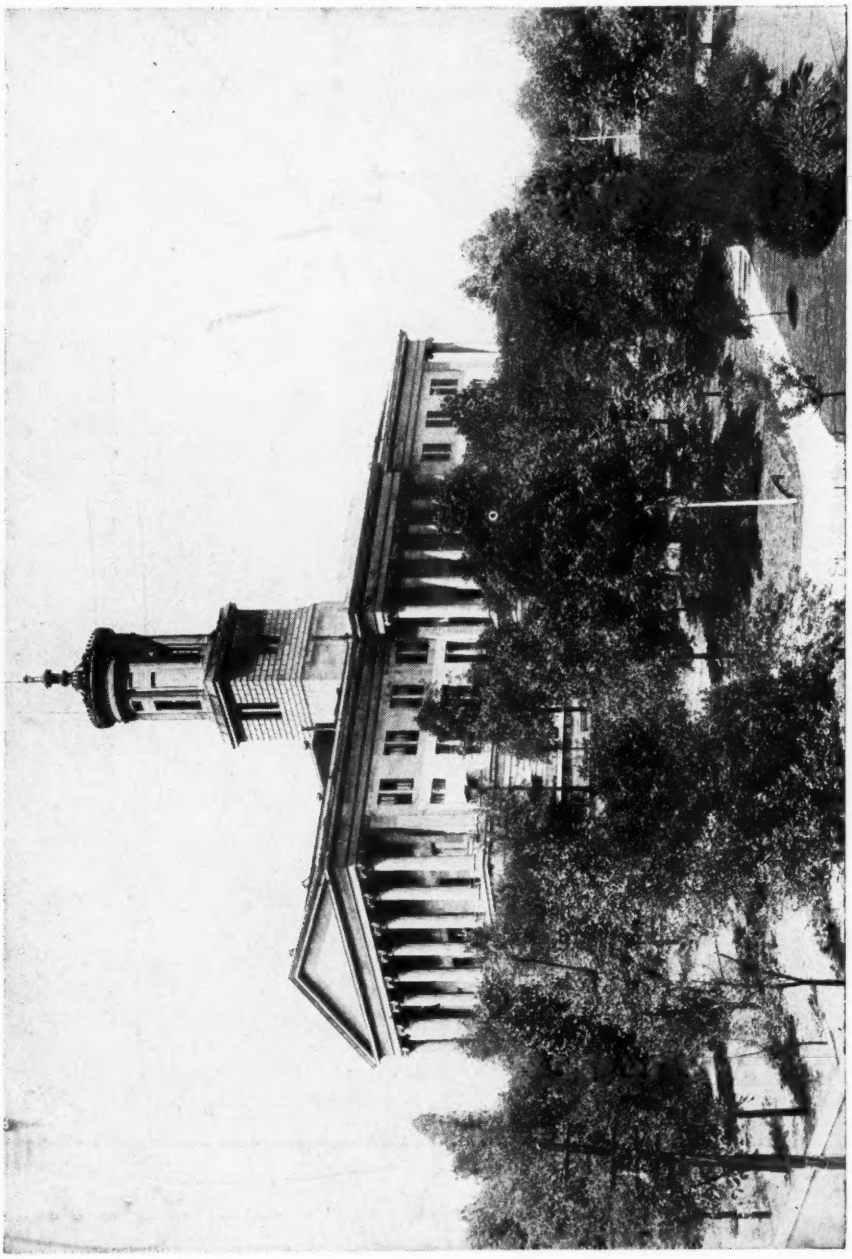
TENNESSEE WAR MEMORIAL BUILDING

Located in the heart of the business district of Nashville, occupying two entire city blocks and facing two additional city blocks, stands the Tennessee War Memorial Building. This was erected jointly by the State of Tennessee, Davidson County and City of Nashville at a cost of $3,500,000 and is considered one of the foremost pieces of architecture in the South.

and Accident Insurance Company Home Office, the Life & Casualty Insurance Company of Tennessee Home Office, all but the latter two being twelve-story office buildings. The entire business district has felt the effect of this building activity. The shopping district is filled with large and commodious stores of all branches of trade, and their stocks are complete and the latest in their respective lines.

OTHER NEW BUILDINGS

Reaching into the educational district this building program of the city has been as marked as in the down-town district. Scarritt College for Christian Workers has erected what has been termed one of the most magnificent school structures of the country, with its stately tower rearing high into the air. It is of the English-Gothic type, and lovers of



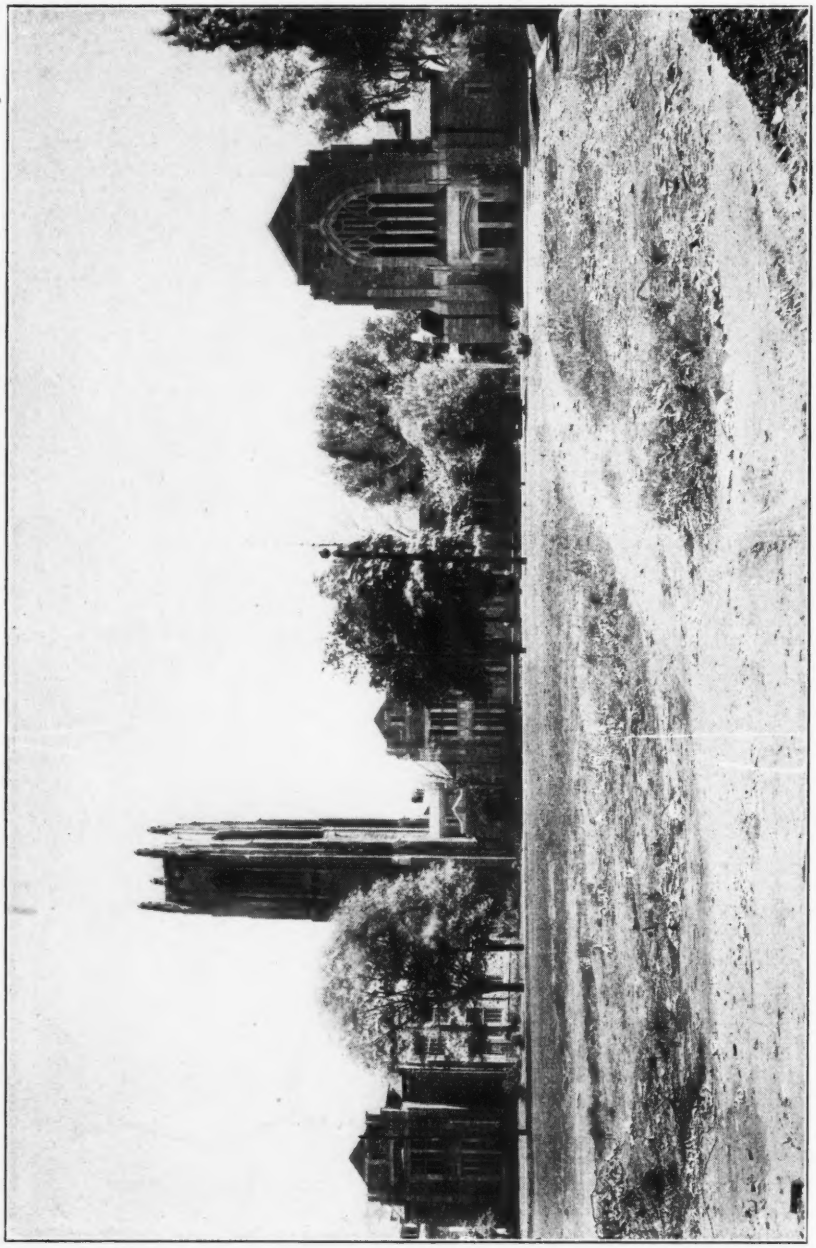
TENNESSEE STATE CAPITOL

Standing on the highest point in the city and ranked as one of the greatest pieces of early American architecture, stands Tennessee's State Capitol Building. This structure was started in 1849 and finished in 1857 and attracts all visitors to Nashville on account of its beauty and imposingness.

architecture will find this something worth seeing. Vanderbilt University has constructed its new hospital and medical school at a cost of $3,500,000, that is rated as the most complete medical school of the South, and in addition a number of other new buildings have been erected on the campus; among them are the Neely Memorial Auditorium and the Alumni Building. Peabody College for Teachers has erected several new buildings on its beautiful campus, and the Southern College Young Men's Christian Association has just completed its

new plant. The Southern School of Printing has also erected a new school home in the educational district.

Just across West End Avenue from Vanderbilt University, at Louise Avenue, the West End Methodist Church has just completed a Sunday School and educational unit that is



SCARRITT COLLEGE FOR CHRISTIAN WORKERS

Only institution of its kind in the world giving college degrees and has just completed its magnificent building that ranks with the most beautiful in the country. Only recently it was awarded the gold medal as the most outstanding educational building shown in the exhibition held at Memphis, by the architects of the country. Its tower is considered one of the most unique structures in college architecture. It was erected by funds raised by the women's missionary societies of the Southern Methodist Church.

considered one of the most complete and beautiful structures in the country and will soon begin the erection of a church building in connection therewith, the entire plant to cost approximately $1,000,000.

EDUCATIONAL NASHVILLE

While mentioning the new buildings in the educational section of Nashville it might be well to say something about the magnificent educational system of the city, that is unsur-

passed anywhere in the world. This embraces a city school system of 42 public schools, high schools and junior high schools. The city also has 38 colleges, universities and boys' and girls' preparatory schools, the combined assets of which amount to more than $42,000,000 and bring to the city more than 10,000 nonresident students each year. The city schools have 26,311 students and 537 teachers. It is a proud boast of Nashville that a child may be

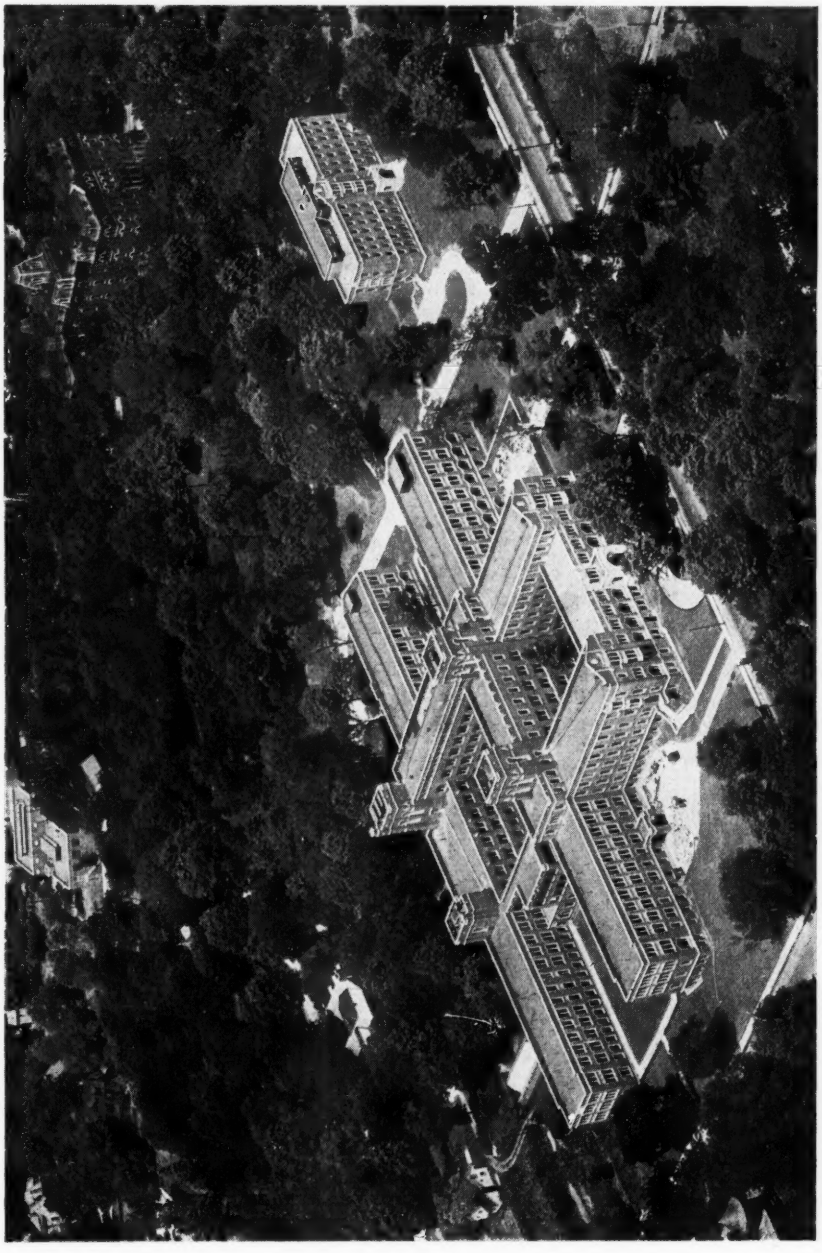


Photo by 105 Observation Squadron NGST

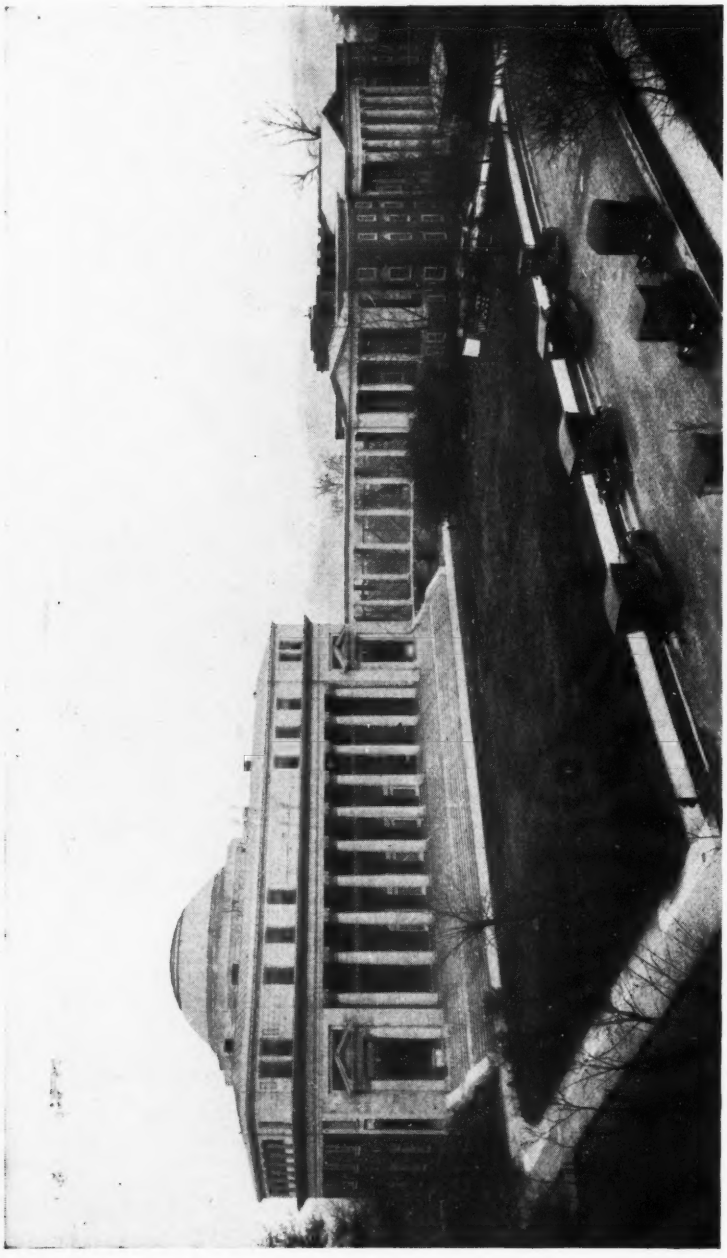
VANDERBILT HOSPITAL AND MEDICAL SCHOOL

Airplane view of the South's most outstanding and complete medical school and hospital, the Vanderbilt University School of Medicine. This was recently completed at a cost of $3,500,000 and is situated in Nashville's famous educational district.

started in the kindergartens, take a public and high school course and almost any desired degree without leaving the city of Nashville. No wonder that Nashville is known as the "Athens of the South," or as one of America's leading educators recently said, the "Athens of the United States."

Among the institutions for higher learning is Vanderbilt University with six schools, arts and science, religion, engineering, medicine, law, and nursing, with assets of $25,000,000

and an entrance requirement and curriculum equal to that of any university in the country. George Peabody College for Teachers has assets of more than $8,000,000 and thirty departments and is the second largest teachers' college in the United States; Ward Belmont College for Young Ladies has its own magnificent campus and ranks as one of the oldest and most noted girls' schools of the country; Scarritt College for Christian Workers is the only school



SOCIAL RELIGIOUS BUILDING, PEABODY COLLEGE FOR TEACHERS

The central portion of the George Peabody College for Teachers group of magnificent buildings, located in Nashville's educational group, the second largest teachers college in the United States.

of its kind in the world giving college degrees; Southern College Young Men's Christian Association is one of three such institutions in the United States and the only one in the South; St. Cecelia Academy and St. Bernard Academy are two strong Catholic institutions located in the city, and the Father Ryan High School ranks with the leading such schools of the country; Trevecca College and David Lipscomb College each has its own plant and grounds. The Nashville Conservatory of Music is the latest addition to Nashville's educational system

and in two years' time has made a most remarkable record. The Southern School of Printing is the only such institution in the South. The Gupton-Jones School of Embalming is another institution of the city that is the only one in its field in the South. Nashville also has the Tennessee School for the Blind, the Tennessee Industrial School and the Boys' Reformatory located in the city. In addition there are several trades schools and some of the strongest business colleges in the country located here.

Nor does Nashville overlook its negro population. The negroes have their own splendid schools and high schools the same as the whites. The United States government recognizes as accredited colleges only three negro institutions, and two of these, Fisk University and Meharry Medical College, are located in Nashville. Fisk University is one of the most noted negro schools of the country, having a complete and thorough course, its own splendid campus and equipment. Its Fisk Jubilee Singers have been heard in every civilized country in the world. Meharry Medical College is the only such institution in the world and has a thorough

WARD-BELMONT SCHOOL FOR YOUNG LADIES

South's oldest and most recognized girls' school having its own beautiful campus and equipment and having an enrollment of five hundred boarding students each year.

medical and dental school. The Tennessee Agricultural and Industrial Normal School is a state institution located in the city. Walden University, Roger Williams University and the American Baptist Theological Seminary are also Nashville institutions.

INDUSTRIAL NASHVILLE

Nashville has more than 300 industrial and manufacturing enterprises that turn out a wide and varied line of products, and these are sold in all parts of the United States and in many foreign countries. The diversification of this manufacturing and industrial output prevents slumps in the industrial life of the city, and Nashville ranks as one of the industrial centers of the South.

Nashville has at Old Hickory, an industrial village twelve miles from the city, a rayon plant employing over 5,000 people and producing 15,000,000 pounds of rayon yarn annually. The only cellophane plant in the South is also located there, as is a new chemical plant. Old Hickory was the site of the gigantic powder plant constructed by the government during the war and since then has been turned into an industrial village of approximately 12,000 people.

Nashville makes more self-rising flour than any other city in the South, grinds more wheat than any other city in the South, makes more stoves than any other city in the South, is one of the two largest hardwood flooring centers of the country, is the South's poultry and egg center and the largest meat packing center in the South. Nashville makes large quantities of work garments, Portland cement, produces twenty million tin cans yearly, has the only inland steel barge plant in the South, makes more bridges than any other city in the South, makes more cotton and burlap bags than any other city in the South, makes more shoes than any other city in the South, makes more furniture than any other city in the South, roasts 104,000,000 pounds of green coffee annually, makes more than 10,000,000 pounds of stock feed annually, has the only clinical thermometer plant in the South and the only plant in the South making marino yarns for the knit goods trade. Nashville is the South's financial center, having five national and eight state banks with resources totaling $139,000,000 and total deposits of $87,601,125, and the bank clearings for 1928 amounted to $1,179,685,804. Nashville is the life and accident insurance center of the South, having five companies with home offices in the city and combined assets of more than $35,000,000. Many other outstanding industrial concerns could be mentioned.

HISTORICAL NASHVILLE AND POINTS OF INTEREST

Nashville from its earliest settlement became one of the most strategic points of the South. Located almost in the center of this section, it enjoyed a prominence such as but few cities have known. In its early days it had such distinguished men as Andrew Jackson, Andrew Johnson and James K. Polk as citizens. It was to Nashville, the capital of the state, that the early molders of history came. It was here that La Fayette came to visit Jackson, as did Aaron Burr and other prominent national figures. This city rose to historical interest because of such men and its importance in the history of the country. It was here that Jackson marshalled his forces for the Creek wars. It was here that Jackson gathered his stalwart Tennessee men to save the country at New Orleans. It was here that his men returned and here that they settled down to live. Samuel Houston, Davy Crockett and others known in history came from this section.

The Hermitage, where Jackson and his beloved Rachel lived, was one of the most noted southern homes. Here Jackson received the great men of the world and entertained them, and it was to the Hermitage that Jackson returned each time he resigned a public office, and he resigned more than any other citizen ever held. It was to the Hermitage that he returned to spend his few remaining days after occupying the president's chair, and here today he sleeps beside his devoted wife. This beautiful old place is now a shrine for Americans. Thousands make pilgrimages to see this old home, maintained today as nearly as possible as it was in Jackson's time. The beautiful old driveway leading to the mansion is bordered with giant cedars that Jackson planted and which form a perfect guitar as they circle the house. Here are the relics of Jackson's day, his old stagecoach, his swords, his letters, valuable state papers, and other possessions. The old garden with its magnolias, its dogwood, and its old-time flowers is still maintained just as it was during Jackson's life.

The old blockhouse, the old fort of the pioneers and many other landmarks have given way to modern progress, but there still remains the lore of those olden times. James Robertson, the founder of Nashville, sleeps in the old City Cemetery. Here also rest the bodies of William Driver, old New England sea captain who named the American Flag "Old Glory," and other pioneers. It was from Nashville that William Walker, "the grey-eyed man of destiny" went forth on his pilgrimages that led him to the presidency of the United States of Central America, only to end by facing a firing squad.

During the Civil War, Nashville was the scene of much activity. First occupied by the Confederates, then by the Federals, the city was considered one of the most important points in the northern portion of the southern states. As a base of supplies it was most important. The Battle of Nashville was fought in what is now in the southern part of the city. Old Fort Negley was one of the chief supports of the city, and although it is now little more than a vacant parcel of ground, it is soon to become a national park.

Nashville was one of the most famous centers of blooded stock in days that have

passed. The old Bellemeade Stud and many other noted stock farms were located here. It is on Bellemeade that the grave of the Enquirer, one of the most famous sires of his day, is located.

In Centennial Park is to be found the Parthenon. This famous building was first erected during the Tennessee Centennial Exposition of 1897. Recently it has been reproduced in permanent form and is now one of the most noted pieces of architecture in America.

Truly Nashville is to prove one of the most interesting and enjoyable meeting places the American Society of Orthodontists has ever selected, and Nashville will be ready to welcome and greet the members of the organization when they arrive. An entertainment program is being arranged and will be announced later.

It might be mentioned in passing that Nashville says to the golfer, "Bring along the old clubs. We have six courses ready and waiting, and all will be open to the visitors."

The Southwestern Society of Orthodontists

The Southwestern Society of Orthodontists will hold its tenth annual session in Oklahoma City on Feb. 24, 25, 26, 1930.

DR. CURTIS WILLIAMS, Sec'y-Treas.,
716 Medical Arts Bldg.,
Shreveport, La.

Oakland Dental Club Opposed to Arizona Law

At a recent meeting of the Oakland Dental Club a resolution was unanimously carried in which the club expressed itself as being opposed to the divorce of orthodontia from dentistry and disapproved of the bill recently passed in Arizona creating a group for the practice of orthodontia separate from dentistry.

In other words, the club is expressly not in favor of the practice of orthodontia being in the hands of any others except those who have previously qualified for the degree to practice general dentistry.

Society for the Advancement of General Anesthesia in Dentistry

On Monday, November 18, 1929, permanent organization was effected, of the Society for the Advancement of General Anesthesia in Dentistry, at the office of Dr. M. Hillel Feldman in New York City.

James T. Gwathmey, M.D., was elected honorary president; M. Hillel Feldman, D.D.S. was elected president; James T. Ivory, D.D.S., of Staten Island, N. Y., vice-president; and Leonard Morvay, D.D.S., of Newark, N. J., secretary.

The purposes of the Society as set forth in the preamble of the constitution are:

"*Whereas,* the utilization of General Anesthesia in Dentistry has been neglected for a number of years, and

"*Whereas,* this has deprived our patients of an agent of inestimable benefit for operations in the mouth, therefore be it

"*Resolved,* that we, a body of general practitioners, organize to foster this purpose.

"The object of this society shall be to promote knowledge of general anesthesia in dentistry among general dental practitioners and to stimulate research along this line."

As such, it is the only organization of its kind in the world. General anesthesia societies are usually in the interest of specialists in anesthesia.

It is planned to hold quarterly meetings. A dinner of the entire society will precede each meeting. The next session is called for February 17, 1930.

The Society pledges itself to abide by the Code of Ethics of the American Dental Association. Special mention was made in the constitution of the pledge of members not to tolerate in any form the division of fees between general practitioners and specialists.

LEONARD MORVAY, Secretary,
76 Clinton Avenue,
Newark, N. J.

Notes of Interest

Dr. B. E. Lischer, of St. Louis, Mo., left January 2 for Berkeley, Calif., where he has accepted an appointment as full-time professor of orthodontia. Dr. Lischer has retired from private practice. He has, since 1924, been a nonresident lecturer in orthodontia at the University of Michigan, and from 1901 to 1924 was professor of orthodontia at the Washington University School of Dentistry.

Dr. William P. Wood, Jr., formerly associated with Dr. Oren A. Oliver of Nashville, Tenn., in the practice of orthodontia, announces that he will assume the practice of the late Dr. John D. Odeneal at 436 West Lafayette Street, Tampa, Fla. Practice limited to orthodontia.

Dr. Ludwig Moss announces the opening of his office for the practice of orthodontia at 114 East Fortieth Street, New York City.

Dr. G. S. Lacock announces the opening of offices at 6147-48 Jenkins Arcade Building, Pittsburgh, Pa., for the practice of orthodontia exclusively.

Dr. T. C. Sparks announces that he has opened his office for the practice of orthodontia and children's dentistry in the Medical Building, 1512 Marion Street, Columbia, South Carolina.

Dr. J. B. Goldsmith announces the removal of his office to 200 West Fifty-Ninth Street, New York City.

Deaths

Dr. H. B. Hamilton of Ithaca, New York, died Tuesday, November 12, 1929.

Dr. Frederick S. Stilwell, forty-eight, well-known orthodontist, collapsed on November 26, 1929. Dr. Stilwell was a member of the Cincinnati Dental Society, the Ohio State Dental Society and an associate member of the Cincinnati Academy of Medicine.

Dr. George B. Palmer died at his home in Koefferam, Sound Beach, Conn., after a year's illness. Dr. Palmer had practiced for thirty-five years. He was graduated from New York University Dental College and was a member of the First District Dental Society, the Connecticut State Dental Society, the New York Society of Orthodontists, and was president of the Eastern Association of Graduates of the Angle School, and very active in all orthodontic society work.